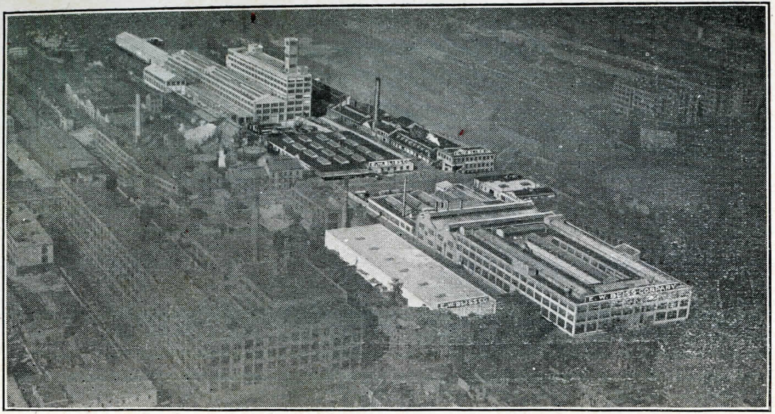
E. W. BLISS CO.
BLISS
BROOKLYN, N.Y.

REFERENCE BOOK



BROOKLYN WORKS

USEFUL INFORMATION

AND ILLUSTRATIONS OF A FEW

STANDARD MACHINES

BUILT BY

E. W. BLISS CO.

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Brooklyn, New York, U. S. A.

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1928

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Borough of Brooklyn, N. Y. City, N. Y.

(PRICE 25 CENTS)

HELP IN CASE OF ACCIDENT

Burns and Scalds.— Cover with cooking soda and lay wet cloths over it. Whites of eggs and olive oil. Olive oil or linseed oil, plain, or mixed with chalk or whitening. Sweet or olive oil and lime-water.

Lightning.— Dash cold water over a person struck.

Sunstroke.— Loosen clothing. Get patient into shade and apply ice-cold water to head. Keep head in elevated position.

Mad Dog or Snake Bite.— Tie cord tight above wound. Suck the wound and cauterize with caustic or white-hot iron at once, or cut out adjoining parts with a sharp knife. Give stimulants, as whiskey, brandy, etc.

Stings of Venomous Insects, etc.—Apply weak ammonia, oil, salt water, or iodine.

Fainting.— Place flat on back; allow fresh air and sprinkle with water. Place head lower than rest of body.

Cinders in the Eye.— Roll soft paper up like a lamplighter, and wet the tip to remove, or use a medicine dropper to draw it out. Rub the *other* eye.

Fire in One's Clothing.—*Don't run*, especially not downstairs or out-of-doors. Roll on carpet, or wrap in woolen rug or blanket. Keep the head down, so as not to inhale flame.

Fire from Kerosene.— *Don't use water*, it will spread the flames. Dirt, sand, or flour is the best extinguisher, or smother with woolen rug, table-cloth or carpet.

Suffocation from Inhaling Illuminating Gas.— Get into the fresh air as soon as possible and lie down. Keep warm. Take ammonia — twenty drops to a tumbler of water, at frequent intervals; also two to four drops tincture nux vomica every hour or two for five or six hours.

If choked.— Get down on all fours and cough.

If any Artery is Cut, compress it above the wound. Blood from an artery is red, that from the veins, dark.

ANTIDOTES FOR POISONS

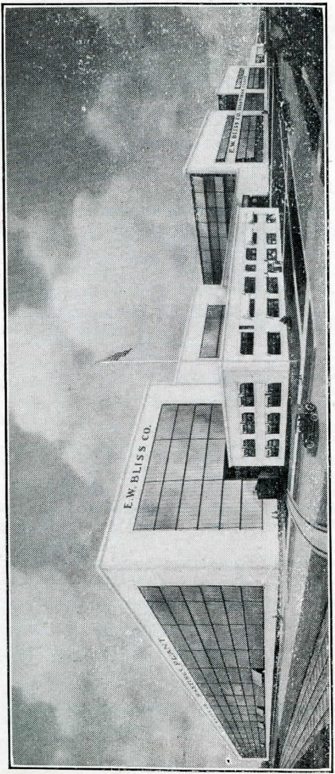
First.— Send for a physician.

Second.— Induce vomiting by tickling the throat with feather or finger. Drink hot water or strong mustard and water. Swallow sweet oil or whites of eggs.

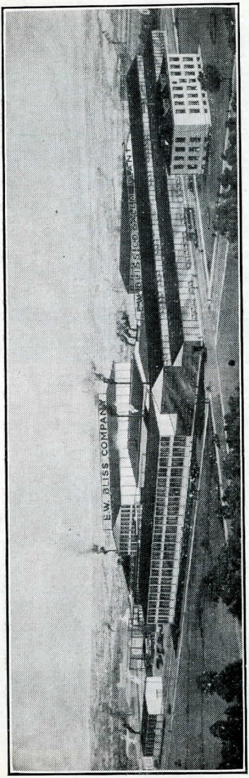
Acids are antidotes for **Alkalies** and *vice versa.*

Special Poisons and Antidotes

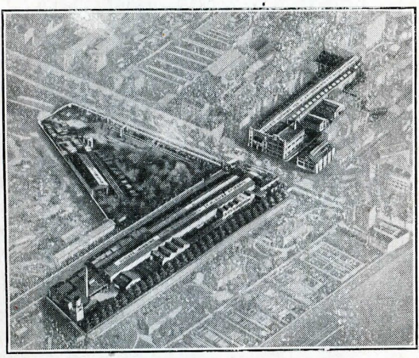
Acids.— Muriatic, Oxalic, Acetic, Sulphuric (Oil of Vitriol), Nitric (Aqua Fortis).	Soapsuds, magnesia, lime-water.
Prussic Acid.	Ammonia in water. Dash water in face.
Carbolic Acid.	Flour and water mucilaginous drinks.
Alkalies.— Potash. Lye. Hartshorn. Ammonia.	Vinegar or lemon juice in water.
Arsenic. Rat Poison. Paris Green.	Milk, raw eggs, sweet oil, lime-water, flour and water.
Bug Poison. Lead. Saltpetre. Corrosive Sublimate. Sugar of Lead. Blue Vitriol.	White of eggs, or milk in large doses.
Chloroform. Chloral. Ether.	Dash cold water on head and chest. Artificial respiration.
Carbonate of Soda. Copperas. Cobalt.	Soapsuds and mucilaginous drinks.
Iodine. Antimony. Tartar Emetic.	Starch and water, astringent in fusions, strong tea.
Mercury and its Salts.	White of eggs, milk, mucilages.
Opium. Morphine. Laudanum. Paregoric. Soothing Powders or Syrups.	Strong coffee, hot bath. Keep awake and moving at any cost.



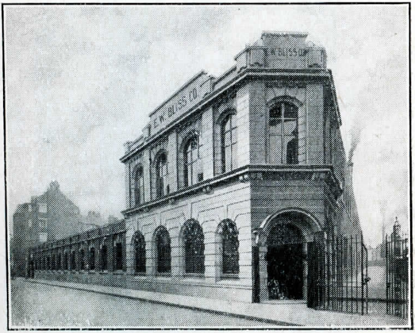
HASTINGS WORKS



SALEM WORKS



PARIS WORKS



LONDON WORKS

THE MANUFACTURING facilities of E. W. Bliss Company are fully abreast of the tremendous development of the Pressed Metal industry. Three completely equipped and highly efficient factories are advantageously located to supply machinery to American trade, while two plants abroad handle foreign demands.

The Brooklyn plant covers approximately 790,000 square feet of floor space.

The Hastings, Michigan, plant produces both "BLISS" presses and "BLISS Consolidated" Type presses in a factory unsurpassed in modern construction and equipment.

The Salem, Ohio, plant is devoted especially to the production of rolling mill equipment and the heaviest types of "BLISS" presses.

The works at London, England, and at Paris, France, are admirably equipped to handle demands from the European trade.

With sales offices located in all the great centers of industry, with a large staff of engineers combining the most up-to-date practice and a range of experience dating from the beginning of the pressed metal industry, and with such unusual manufacturing facilities, E. W. Bliss Company is able to give exceptional service.

WE BUILD

A very complete line of standard machines and tools, including Single-Action Power Presses, Adjustable Power Presses, Double-Crank Presses, Double-Crank Double-Action Presses, Power Punching and Shearing Presses, Embossing Presses, Reducing Presses, Double-Action Presses, Triple-Action Presses, Cutting, Drawing and Stamping Presses, Toggle-Drawing Presses, Double-Crank Toggle-Drawing Presses, Two-Step Toggle-Drawing Presses, Spinning Lathes, Board and Belt Drop Hammers, Pneumatic Forging Hammers, Forging Presses, Screw Presses, Lever and Pendulum Presses, Circle Shears, Slitting Shears, Squaring Shears, Thread Rolling Machines, Wire Handle and Wire Ring Machines, Round and Square Can Machines, Double-Seaming Machines, Crimping, Trimming and Notching Machines, Beading Machines, Solder Moulds and Solder Cutters, Soldering Machines, Can Cleaning Machines, and many others. Also complete Cold Rolling Mill Equipments, Drop Forging Equipments, and a complete line of Automatic Can Making Machinery. Dies for all purposes.

We also design and build machinery for special purposes and will be pleased to estimate on same.

OUR MACHINERY AND DIES ARE ADAPTED TO THE USE OF MANUFACTURES OF

Agricultural Implements,
Aluminum Articles,
Bath Boilers,
Brass Goods,
Bottle Caps and Capsules,
Britannia Ware,
Buckles,
Burners,
Cigarette Boxes,
Clocks,
Coal Hods,
Cuspidors,
Cutlery,
Dripping Pans,
Drop Forgings,
Electrical Goods,
Elevator Buckets,
Forks and Spoons,
Fruit Cans,
Gas Fixtures,
Hardware,
Hinges,
Horseshoes,
Jewelry,
Kitchen Boilers,
Kitchen Utensils,
Lamps and Lanterns,
Lard Pails,
Locks,
Match Boxes,
Metallic Ceilings,
Metal Furniture,
Metal Laths,
Milk Cans,
Musical Instruments,
Oil Stoves,
Paint Cans,
Paint Tubes,
Playing Cards,
Powder Kegs,
Range Boilers,
Silverware,
Sinks,
Shovels,
Spoons,
Stove Trimmings,
Toys,
Tin Cans of every kind,
Tinware,
Trunk Trimmings,
Vapor Stoves,
Varnish Cans,
Vegetable Cans,
Watches,
Wrought Iron Ranges,
Wash Tubs,
Zinc Work.

And many other Staple and Special Lines of Goods.

SECTIONAL CATALOGUES MAILED ON APPLICATION

Section 1. Clutches and Slide-Connections.
“ 2. "Bliss" Inclinable Power Presses.
“ 3. Overhanging and Arch Power Presses.
“ 4. Horning, Wiring and Lock-Seaming Presses.
“ 5. "Stiles" Punching Presses.
“ 6. Straight-Side, Embossing and Reducing Presses.
“ 7. Trimming Presses — Single and Double-Crank, Straight-Side and Overhanging.
“ 8. Drop Hammers.
“ 9. Double-Crank Presses.
“ 10. Perforating Presses and Multiple Punches.
“ 11. Cam and Toggle-Drawing Presses and Spinning Lathes.
“ 12. Automatic Feeds and Presses with Feeds.
“ 13. Foot and Screw Presses.
“ 14. Trimming, Beading, Wiring, Flanging and Thread-Rolling Machines.
“ 15. Double-Seaming Machines.
“ 16. Shears and Slitters.
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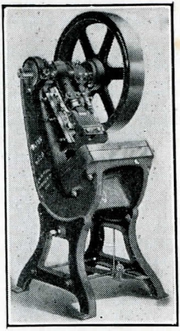
“ 18. Automatic Can-Making Machinery.
“ 19. Petroleum-Can Machinery.



"BLISS" INCLINABLE POWER PRESSES—18 sizes, weighing from 500 to 8,000 lbs., either as "Fly-Wheel" or "Geared" Presses. Adapted for tin, sheet-brass, sheet-steel work, etc.

TAP DRILLS—For Pipe Taps

The sizes of Twist Drills to be used in boring holes to be reamed with Pipe Reamer, and threaded with Pipe Tap, are as follows:

Size Inches	No. Threads to Inch	Size of Drill Inches	Size Inches	No. Threads to Inch	Size of Drill Inches
⅛	27	.3281	1½	11½	1.7187
¼	18	.4531	2	11½	2.1875
⅜	18	.5937	2½	8	2.6875
½	14	.7187	3	8	3.3125
¾	14	.9375	3½	8	3.8125
1	11½	1.1875	4	8	4.3125
1¼	11½	1.4687			

From The Standard Tool Co.

TAP DRILLS

For Machine and Hand Taps

These tables give the diameter of Drills in thousandths of an inch for holes to be tapped, and is an allowance above actual bottom diameter size of thread, of from .015 of an inch for a ¼-inch Tap, to .062 for a 2-inch Tap for "V" thread; and of .004 of an inch for a ¼-inch Tap, to .010 for a 2-inch Tap for U. S. Standard thread; and .019 of an inch for a No. 2 to .040 for a No. 30 Screw Gauge Tap.

Diameter Tap Inches	No. Threads to Inch	Drill for "V" Thread	Diameter Tap Inches	Drill for U. S. Standard Thread
¼	20, 24, 32	.179, .193, .211	¼	0.189
9/32	20, 24, 32	.211, .226, .242		
5/16	18, 20, 24	.234, .243, .255	5/16	0.244
11/32	18, 20, 24	.266, .277, .289		
⅜	14, 16, 18	.272, .290, .296	⅜	0.298
13/32	14, 16, 18	.303, .316, .328		
7/16	12, 14, 16	.316, .339, .348	7/16	0.349
15/32	12, 14, 16	.349, .370, .386		
½	12, 13, 14	.382, .393, .401	½	0.405
17/32	12, 13, 14	.415, .423, .435		
9/16	12, 14, 27	.450, .469, .528	9/16	0.459
19/32	12, 14, 27	.482, .500, .560		
⅝	10, 11, 12	.484, .500, .515	⅝	0.512
21/32	10, 11, 12	.517, .531, .547		
¾	10, 12, 20	.612, .640, .697	¾	0.625
25/32	10, 12, 20	.644, .672, .734		
⅞	9, 10, 12	.719, .736, .765	⅞	0.737
29/32	9, 10, 12	.752, .767, .796		
1	8, 12,	.823, .900	1	0.844
1 1/32	8, 12,	.856, .927		
1⅛	7, 8	.922, .953	1⅛	0.947
1 5/32	7, 8	.954, .984		
1¼	7, 12	1.049, 1.155	1¼	1.072
1 9/32	7, 12	1.081, 1.184		
1⅜	6	1.134	1⅜	1.167
1 13/32	6	1.166		
1½	6	1.261	1½	1.292
1 17/32	6	1.294		
1⅝	5	1.330	1⅝	1.398
1 21/32	5	1.362		
1¾	5	1.458	1¾	1.500
1 25/32	5	1.491		
1⅞	4½	1.543	1⅞	1.625
2	4½	1.672	2	1.722

From Standard Tool Co.

SPEED OF DRILLS

From Union Twist Drill Co.

The following table shows the revolutions per minute for Drills from 1/16 inch to 2 inches diameter, as usually applied.

Diam. of Drills, Inches	Speed for Wrought Iron and Steel	Speed for Cast Iron	Speed for Brass
1/16	1712	2383	3544
1/8	855	1191	1772
3/16	571	794	1181
1/4	397	565	855
5/16	318	452	684
3/8	265	377	570
7/16	227	323	489
1/2	183	267	412
9/16	163	238	367
5/8	147	214	330
11/16	133	194	300
3/4	112	168	265
13/16	103	155	244
7/8	96	144	227
15/16	89	134	212
1	76	115	191
1 1/16	72	108	180
1 1/8	68	102	170
1 3/16	64	97	161
1 1/4	58	89	150
1 5/16	55	84	143
1 3/8	53	81	136
1 7/16	50	77	130
1 1/2	46	74	122
1 9/16	44	71	117
1 5/8	40	66	113
1 11/16	38	63	109
1 3/4	37	61	105
1 13/16	36	59	101
1 7/8	33	55	98
1 15/16	32	53	95
2	31	51	92

These speeds should seldom be exceeded. Feed per revolution for 1/4 inch Drill .005 inch; for 1/2 inch Drill, .007 inch; for 3/4 inch Drill, .010 inch.

SIZES OF TWIST DRILLS FROM ½ INCH TO NO. 25,- WITH DECIMAL EQUIVALENTS

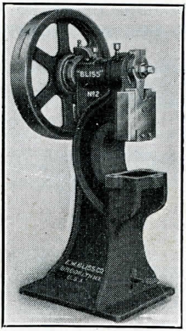
SIZE	Equivalent Decimals of 1 inch	SIZE	Equivalent Decimals of 1 inch
1-2	0.5000	E 1-4	0.2500
31-64	0.4844	D	0.2460
15-32	0.4687	C	0.2420
29-64	0.4531	B	0.2380
7-16	0.4375	15-64	0.2344
27-64	0.4219	A	0.2340
Z	0.4130	No. 1	0.2280
13-32	0.4062	2	0.2210
Y	0.4040	7-32	0.2187
X	0.3970	3	0.2130
25-64	0.3906	4	0.2090
W	0.3860	5	0.2055
V	0.3770	6	0.2040
3-8	0.3750	13-64	0.2031
U	0.3680	7	0.2010
23-64	0.3594	8	0.1990
T	0.3580	9	0.1960
S	0.3480	10	0.1935
11-32	0.3437	11	0.1910
R	0.3390	12	0.1890
Q	0.3320	3-16	0.1875
21-64	0.3281	13	0.1850
P	0.3230	14	0.1820
O	0.3160	15	0.1800
5-16	0.3125	16	0.1770
N	0.3020	17	0.1730
19-64	0.2969	11-64	0.1719
M	0.2950	18	0.1695
L	0.2900	19	0.1660
9-32	0.2812	20	0.1610
K	0.2810	21	0.1590
J	0.2770	22	0.1570
I	0.2720	5-32	0.1562
H	0.2660	23	0.1540
17-64	0.2656	24	0.1520
G	0.2610	25	0.1495
F	0.2570		

From The Standard Tool Co.

SIZES TWIST DRILLS FROM NOS. 26 TO 80, WITH DECIMAL EQUIVALENTS

SIZE	Equivalent Decimals of 1 inch	SIZE	Equivalent Decimals of 1 inch
26	0.1470	3-64	0.0469
27	0.1440	56	0.0465
9-64	0.1406	57	0.0430
28	0.1405	58	0.0420
29	0.1360	59	0.0410
30	0.1285	60	0.0400
1-8	0.1250	60½	0.0390
31	0.1200	61	0.0380
32	0.1160	62	0.0370
33	0.1130	63	0.0360
34	0.1110	64	0.0350
35	0.1100	65	0.0330
7-64	0.1094	66	0.0320
36	0.1065	1-32	0.0312
37	0.1040	67	0.0310
38	0.1015	68	0.0300
39	0.0995	68½	0.0292
40	0.0980	69	0.0290
41	0.0960	69½	0.0280
3-32	0.0937	70	0.0270
42	0.0935	71	0.0260
43	0.0890	71½	0.0250
44	0.0860	72	0.0240
45	0.0820	73	0.0230
46	0.0810	73½	0.0225
47	0.0785	74	0.0220
5-64	0.0781	74½	0.0210
48	0.0760	75	0.0200
49	0.0730	76	0.0180
50	0.0700	77	0.0160
51	0.0670	1-64	0.0156
52	0.0635	78	0.0150
1-16	0.0625	78½	0.0145
53	0.0595	79	0.0140
54	0.0550	79½	0.0135
55	0.0520	80	0.0130

From The Standard Tool Co.



"STILES" PUNCHING PRESSES—11 sizes, weighing from 550 to 13,000 lbs. Adapted for the manufacture of general hardware, electrical goods, etc.

AMOUNT OF STOCK WHICH SHOULD BE LEFT FOR REAMING

When a roughing reamer is used before the finishing reamer, the approximate amount of stock left in hole for finishing reamer to ream, should be as follows:

In 1″ to 1½″ hole, from .0015 to .002.
In 2″ to 3″ hole, from .003 to .004.
In 4″ to 5″ hole, from .005 to .006.
In 6″ hole, from .008 to .010.

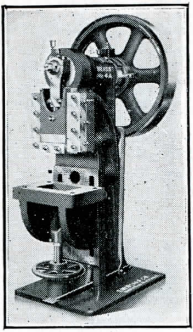
Should the holes be only drilled or bored without roughing reamer, the amount left for finishing reamer should be sufficient for the reamer to cut all marks left from the boring, being about twice the amount mentioned above.

LUBRICANTS FOR CUTTING TOOLS

From Morse Twist Drill Catalogue

Material	Turning	Chucking	Drilling	Reaming	Tapping Milling
Tool Steel	Dry or Oil	Oil or Soda Water	Oil	Lard Oil	Oil
Soft Steel	Dry or Soda Water	Soda Water	Oil or Soda Water	Lard Oil	Oil
Wrought Iron	Dry or Soda Water	Soda Water	Oil or Soda Water	Lard Oil	Oil
Cast Iron	Dry	Dry	Dry	Dry	Dry
Brass	Dry	Dry	Dry	Dry	Dry
Copper	Dry	Dry	Dry	Mixture	Dry
Babbitt	Dry	Dry	Dry	Dry	Dry
Glass	Turpentine or Kerosene				

Mixture is one-third Crude Petroleum, two-thirds Lard Oil. Oil is Sperm or Lard, Sperm preferable. When two lubricants are mentioned the first is preferable.



"STILES" ADJUSTABLE-BED PRESSES—Built in 4 sizes as flywheel or geared presses. Weights 2300 to 10,500 lbs. Adapted for forming and bending operations and for work requiring a longer stroke than is practicable on the "Stiles" standard pattern of press.

SIMPLE RULES ON GEARING

The following rules will apply to both Bevel and Spur Gears. When the term "pitch" is used, it always signifies diametral (not circular) pitch. For illustrations we will use gears having 64 teeth and 8 pitch,

To Find Pitch Diameter.—Divide the number of teeth by the pitch: 64 ÷ 8 = 8 in. p. diam.

To Find Number of Teeth.—Multiply the pitch diam. by the pitch: 8 in. × 8 = 64, number of teeth.

To Find the Pitch.—Divide the number of teeth by the pitch diam.: 64 ÷ 8 in. = 8, pitch.

(Continued on next page.)

SIMPLE RULES ON GEARING—Continued.

To Find Outside Diameter of Spur Wheels.—Add 2 to the number of teeth and divide by the pitch: $64+2=66\div8=8\frac{1}{4}$ in., O. D.

To Find Circular Pitch.—Divide the decimal 3.1416 by the diametral pitch: $3.1416\div8=.3927$ in.

To Find the Distance Between the Centers of Two Spur Gears.—Divide half the sum of the teeth of both gears by the pitch: $64+64=128\div2=64\div8=8$ in. centers.

A simple rule to determine the face of bevel gears is to make them 7 times the pitch: 8 pitch bevel will thus be $\frac{7}{8}$ in. face.

To say 3 P. or 3 Pitch means 3 Diametral Pitch.

To say 3″ P. or 3-inch Pitch means 3-inch Circular Pitch.

SPEEDS—EMERY WHEELS—GRINDSTONES—POLISHING WHEELS

Speed of Emery Wheels

The speed most strongly recommended by their manufacturers is a peripheral velocity of 5,600 feet per minute for all sizes. All things being considered, it is stated that no advantage is gained by exceeding this speed. If run much slower than this, the wear on the wheels is much greater in proportion to the work accomplished, and if run much faster, the wheel is likely to burst.

Speed of Grindstones

Grindstones used for grinding machinists' tools are usually run so as to have a peripheral speed of about 900 feet per minute, and those used for grinding carpenters' tools at about 600 feet per minute. With regard to safety, it may be stated in general that with any size of grindstone having a compact and strong grain, a peripheral velocity of 2,800 feet per minute should not be exceeded.

Speed of Polishing Wheels

Polishing wheels are run at about the following peripheral speeds:

	Ft. per Min.
Leather-covered wooden wheels . . .	about 7,000
Walrus-hide wheels	about 8,000
Rag wheels, 4 in. to 8 in. dia.	about 7,000

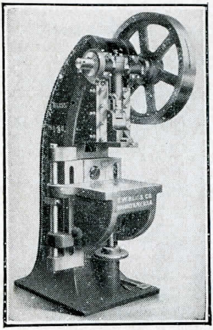


Fig. 1. Press arranged with swinging table.

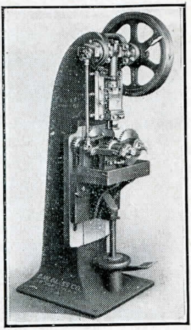


Fig. 2. Press arranged for perforating cylinders.

"BLISS" HORN AND WIRING PRESSES—

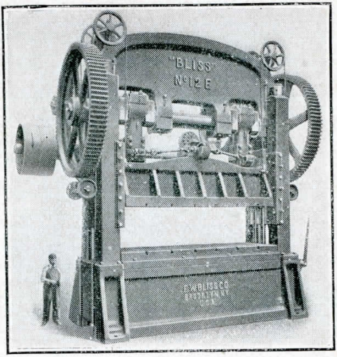
18 sizes and several styles, some of them with automatic die slide for work up to 24 inches diameter. Weights, 1,100 to 7,500 lbs.

SPEED OF MILLING CUTTERS—*Kent.*

The cutting speed for milling was originally fixed very low; but experience has shown that with the improvements now in use it may with advantage be considerably increased especially with cutters of large diameter. The following are recommended as safe speeds for cutters of 6 in. and upwards, provided there is not any great depth of material to cut away:

	Feet per min.	Feed, in. per min.
Steel..............	36	½
Wrought Iron	48	1
Cast Iron.......	60	1⅔
Brass..............	120	2⅔

Should it be desired to remove any large quantity of material, the same cutting-speeds are still recommended, but with a finer feed.



"BLISS" AND "STILES" STRAIGHT-SIDE DOUBLE-CRANK PRESSES.—Built in over 150 different types and sizes, weighing from 2500 to 260,000 lbs. For heavy blanking, stamping and punching of large dimensions.

SPEED OF CUT FOR LATHES AND PLANERS.—*Kent.*

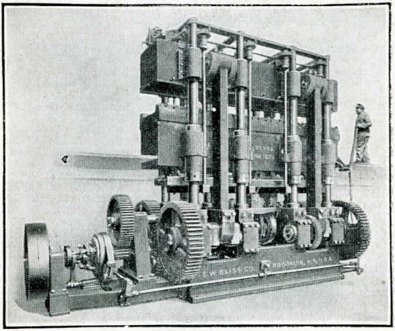
Brass may be turned at high speed like wood.

Bronze.—A speed of 18 ft. a minute can be used with the soft alloys—say 8 to 1, while for hard mixtures a slow speed is required—say 6 feet per minute.

Wrought Iron can be turned at 40 feet per minute, but planing-machines that are used for both cast and forged iron are operated at 25 feet per minute.

Machinery Steel.—Ordinary, 14 feet per minute; car-axles, etc., 9 feet per minute.

Wheel Tires.—6 feet per minute; the tool stands well, but many prefer to run faster, say 8 to 10 feet, and grind the tool more frequently.



"BLISS" MULTIPLE CRANK FORMING PRESS—Adapted for forming automobile side-frames and cross-rails, steel car frames, fence posts, channels, angles, etc.

CALCULATING SPEED OF PULLEYS

Example.—A main shaft running 110 revolutions and a countershaft with 8-inch tight and loose pulleys running 220 revolutions.

To Find Size of Pulley on Main Shaft—Multiply diameter of pulley on countershaft by its number of revolutions, and divide the product by number of revolutions of main shaft. The quotient will be its diameter: 8 × 220 = 1760, 1760 ÷ 110 = 16 inches diameter.

(Continued on next page.)

CALCULATING SPEED OF PULLEYS—Continued

To Find Number of Revolutions of Countershaft—Multiply diameter of pulley on main shaft by its number of revolutions, and divide product by diameter of pulley on countershaft: $16 \times 110 = 1760$, $1760 \div 8 = 220$ revolutions.

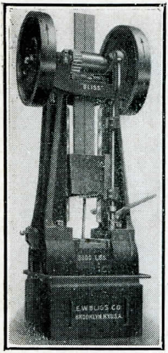
To Find Size of Pulley on Countershaft—Multiply diameter of pulley on main shaft by its number of revolutions, and divide product by number of revolutions of countershaft: $16 \times 110 = 1760$, $1760 \div 220 = 8$ inches diameter.

STANDARD SIZES OF KEY SEATS

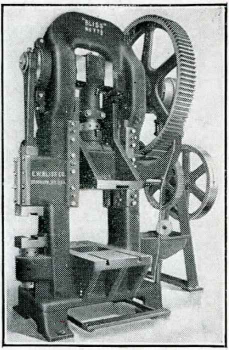
For Pulleys, Sheaves, Etc.

Diameter of Shaft Inches	Size of Key Seat	
	Width Inches	Depth Inches
¾ to 1¼ inclusive......	¼	⅛
1 5/16 to 1¾ "	⅜	3/16
1 13/16 to 2¼ "	½	¼
2 5/16 to 2¾ "	⅝	5/16
2 13/16 to 3¼ "	¾	⅜
3 5/16 to 3¾ "	⅞	7/16
3 13/16 to 4¼ "	1	½
4 5/16 to 4¾ "	1⅛	9/16
4 13/16 to 5¼ "	1¼	⅝
5 5/16 to 5¾ "	1⅜	11/16
5 13/16 to 6¼ "	1½	¾
6 5/16 to 7¼ "	1¾	¾
7 5/16 to 8¼ "	2	¾
8 5/16 to 9¼ "	2¼	¾
9 5/16 to 10¼ "	2½	¾
10 5/16 to 11¼ "	2¾	¾

All key seats on clutch extended sleeves under 8 inches outside diameter are above widths, but only ¼ inch deep, and on sleeves 8 inches diameter and larger ⅜ inch deep.



"STILES"
DROP HAMMER



"BLISS"
TRIMMING PRESS

DROP FORGING EQUIPMENTS

We fit out Drop Forging plants, with the most up-to-date machinery, including Drop Hammers, Dies, Trimming Presses, etc.

Pamphlet describing this machinery sent on request.

TO CALCULATE THE DRIVING POWER OF BELTS

Divide the speed in feet per minute by 1,100; the quotient will be the horse-power per inch of the belt's width that is allowed in good practice to be transmitted by single thickness leather belting having laced joints. Although this is the best practice, the amount is often exceeded by as much as 25 per cent. with satisfactory results, though the life of the belt is shortened.

(Continued on next page.)

TO CALCULATE THE DRIVING POWER OF BELTS—Continued

Double thickness belts will transmit twice and triple thickness belts three times as much power as single thickness belts.

Spliced belts will transmit a third more power than those that are laced.

The adhesion of belts to pulleys and the consequent driving power vary so much under different conditions of use that some intelligent deviation is occasionally necessary from any simple rule. From the horse power given by the above rule, therefore, some deduction should be made when the belt is vertical or inclined instead of horizontal; when the arc of contact on the pulley is much less than 180 degrees or a "half wrap"; when the speed of the belt is less than 900 feet per minute, and also when one or both of the pulleys are small in diameter.

Five per cent. should be deducted for every 10 degrees less than a "half wrap."

Twenty-five per cent. should be deducted for vertical belts when used without a tightening pulley.

In the case of small pulleys deduct as follows:

		From
Deduct from 0 to 60% for	single belts on pulleys	12″ to 2″ dia.
	double " "	24 to 6 "
	triple " "	36 to 15 "

When circumstances permit, the best speed for belts is about 5,000 feet per minute. The adhesion is then so good as to require less stretching of the belt, with less consequent loss of power by friction.

The smoother the surface of the pulleys and of the belt surface in contact with them the better the adhesion and the more driving power. It is therefore sometimes found of benefit in the case of low belt speed or of pulleys of small diameter to cover the pulleys with leather or to make them of wood, polished, and to run the hair side of the belts in contact with the pulley faces.

APPROXIMATE HORSE POWER TRANSMITTED BY LEATHER BELTS

(A) Single Belts 1 Inch Wide, 800 Feet per Minute—1 Horse Power

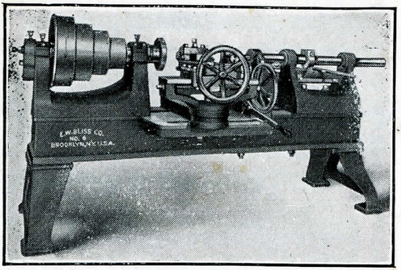
Speed in Feet per Minute	WIDTH OF BELT IN INCHES											
	2	3	4	5	6	8	10	12	14	16	18	20
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
400	1	1½	2	2½	3	4	5	6	7	8	9	10
600	1½	2¼	3	3¾	4½	6	7½	9	10½	12	13½	15
800	2	3	4	5	6	8	10	12	14	16	18	20
1000	2½	3¾	5	6¼	7½	10	12½	15	17½	20	22½	25
1200	3	4½	6	7½	9	12	15	18	21	24	27	30
1500	3¾	5¾	7½	9½	11½	15	18¾	22½	26½	30	33¾	37
1800	4½	6¾	9	11¼	13½	18	22½	27	31½	36	40½	45
2000	5	7½	10	12½	15	20	25	30	35	40	45	50
2400	6	9	12	15	18	24	30	36	42	48	54	60
2800	7	10½	14	17½	21	28	35	42	49	56	63	70
3000	7½	11¼	15	18¾	22½	30	37½	45	52½	60	67½	75
3500	8¾	13	17½	22	26	35	44	52½	61	70	79	88
4000	10	15	20	25	30	40	50	60	70	80	90	100
4500	11¼	17	22½	28	34	45	57	69	78	90	102	114
5000	12½	19	25	31	37½	50	62½	75	87½	100	112	125

APPROXIMATE HORSE POWER TRANSMITTED BY LEATHER BELTS—Continued

(B) Double Belts 1 Inch Wide, 550 Feet per Minute—1 Horse Power

Speed in Feet Per Minute	WIDTH OF BELT IN INCHES										
	4	6	8	10	12	14	16	18	20	22	24
	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.	H. P.
400	2¾	4¼	5¾	7¼	8½	10	11½	13	14½	16	17½
600	4¼	6½	8¾	11	13	15	17½	19½	22	24	26
800	5¾	8½	11½	14½	17½	20½	23	26	29	32	34½
1000	7¼	11	14½	18¼	21½	25½	29	32½	36	40	43½
1200	8½	13	17½	22	26	30¾	34½	39	44	48	52½
1500	10¾	16¼	21¾	27¼	32½	38	43½	49	54½	60	65½
1800	13	19½	26	32¾	39	45½	52	59	65½	72	78½
2000	14½	21¾	29	36½	43½	50½	58	65½	72½	80	87
2400	17¼	26	34¾	44	52½	60½	69½	78½	88	96	105
2800	20¼	30½	40½	51	61	71	81	91½	102	112	122
3000	21½	32½	43½	54½	65½	76	87½	98	108	120	131
3500	25½	38	50¾	63½	76	89	101	114	127	140	153
4000	29	43½	58¼	72¾	87	101	116	131	147	160	174
4500	32½	49	65	82	98	114	131	147	163	180	196
5000	36½	54½	72¾	91	109	127	145	163	182	200	218

N. B.—Belts are supposed to be not overstrained, so they will last.



"BLISS" SPINNING LATHES.—These lathes built in 6 sizes, are for spinning, burnishing, trimming and wiring the work produced in Drawing Presses.

LINE SHAFTING

The speed of a shaft is fixed largely by the speed of the driving belt or the diameters of the pulleys upon it. In general, machine-shop shafts run about 140 to 200 revolutions per minute; shafts driving wood-working machinery about 250 to 300 revolutions per minute; in cotton mills, the practice is to make the shafts' diameter smaller and run at a higher speed, say 300 to 400 revolutions per minute. Line shafts should generally not be less than 1¾ inches in diameter.

The distance between the bearings should not be great enough to permit a deflection of more than 1-100 inch per foot of length; hence the bearings must be closer when the shaft is heavily loaded with pulleys.

Ordinary practice for distance between journals is from 8 to 10 feet apart, this distance varying according to size of shaft and power transmitted. Pulleys that give out a large amount of power should be placed as near a hanger as possible.

HORSE-POWER TRANSMITTED BY COLD-ROLLED STEEL LINE SHAFTING

Diameter of Shaft	No. of Revolutions per Minute												
	100	125	150	175	200	225	250	300	350	400	450	500	600
1½	4.8	6.0	7.2	8.4	9.6	10.8	12.0	14.4	16.9	19.2	22	24	29
1 9/16	5.5	6.8	8.2	9.5	10.9	12.2	13.6	16.4	19	22	25	27	33
1⅝	6.1	7.6	9.2	10.7	12.2	13.8	15.3	18.4	21	24	28	31	37
1 11/16	6.9	8.6	10.3	12.0	13.7	15.4	17.1	21	24	27	31	34	41
1¾	7.7	9.6	11.5	13.4	15.3	17.2	19.1	23	27	31	34	38	46
1 13/16	8.5	10.6	12.7	14.8	16.9	19.0	21	25	30	34	38	42	51
1⅞	9.4	11.7	14.1	16.4	18.8	21	23	28	33	38	42	47	57
1 15/16	10.4	13.0	15.6	18.2	21	23	26	31	36	42	47	52	62
2	11.4	14.3	17.2	20	23	26	29	34	40	46	51	57	69
2 1/16	12.6	15.7	18.9	22	25	28	31	38	44	50	56	63	76
2⅛	13.7	17.1	21	24	27	31	34	41	48	55	61	68	82
2 3/16	15.0	18.7	22	26	30	34	37	45	52	60	67	75	90
2¼	16.3	20	24	29	33	37	41	49	57	65	73	81	98
2 5/16	17.7	22	27	31	35	40	44	53	62	71	80	88	106
2⅜	19.2	24	29	34	38	43	48	57	67	76	86	96	115
2 7/16	20	25	30	36	41	46	51	61	72	81	91	102	122
2½	22	28	33	39	45	50	56	67	78	89	100	112	133
2 9/16	24	30	36	42	48	54	60	72	84	96	108	120	144
2⅝	26	32	39	45	52	58	64	77	90	104	116	129	155
2 11/16	28	35	42	48	55	62	69	83	97	111	124	138	166
2¾	30	37	44	52	59	67	74	89	104	119	133	148	178
2 13/16	32	40	47	55	63	71	79	95	111	127	143	159	190
2⅞	34	42	51	59	68	76	85	101	119	135	152	169	203
2 15/16	36	45	54	63	72	81	90	108	127	144	162	181	217
3	39	48	58	67	77	87	96	116	135	154	173	192	231
3⅛	44	54	65	76	87	98	109	131	152	174	196	218	261
3¼	49	61	73	86	98	110	122	147	172	196	221	245	294
3⅜	55	69	83	96	110	124	137	165	192	220	247	275	330
3½	61	77	92	107	123	138	153	184	214	245	276	307	367
3⅝	68	85	102	119	136	153	170	204	238	272	306	340	408
3¾	75	94	113	132	151	170	189	226	264	301	340	377	452
3⅞	83	104	125	145	166	187	207	249	291	332	379	415	498
4	92	114	137	160	183	206	229	274	320	366	411	457	549
4⅛	101	125	150	175	201	226	251	300	351	401	451	501	601
4¼	110	137	164	192	219	246	273	328	383	438	492	547	657
4⅜	120	150	180	210	239	268	298	358	418	478	538	597	717
4½	130	163	195	228	261	293	326	391	455	521	586	651	781
4⅝	141	177	212	247	283	318	354	425	495	566	636	707	848
4¾	153	191	230	268	307	344	382	459	537	613	688	765	919
4⅞	166	207	249	290	331	372	413	496	580	662	745	827	994
5	179	224	268	313	358	402	447	537	625	715	805	895	1074

From Industrial Press "Machinery"

TIME REQUIRED FOR CUTTING TOOL TO TRAVEL 1 INCH, WHEN THE FEED IS 1-32 INCH PER REVOLUTION.

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Diam.	Surface Speeds per Minute															
	20 Feet		25 Feet		30 Feet		35 Feet		40 Feet		45 Feet		50 Feet		60 Feet	
Ins.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.	Min.	Sec.
1	0	25	0	20	0	17	0	14	0	12	0	11	0	10	0	8
2	0	50	0	40	0	33	0	29	0	25	0	22	0	20	0	17
3	1	15	1	0	0	50	0	43	0	38	0	33	0	30	0	25
4	1	40	1	20	1	7	0	57	0	50	0	45	0	40	0	33
5	2	6	1	41	1	24	1	12	1	3	0	56	0	50	0	42
6	2	31	2	1	1	41	1	26	1	15	1	7	1	0	0	50
7	2	56	2	21	1	57	1	41	1	28	1	18	1	10	0	58
8	3	21	2	41	2	14	1	55	1	40	1	29	1	20	1	7
9	3	46	3	1	2	31	2	9	1	53	1	41	1	30	1	15
10	4	11	3	21	2	48	2	24	2	6	1	52	1	41	1	24
11	4	36	3	41	3	4	2	38	2	18	2	3	1	51	1	32
12	5	2	4	1	3	21	2	52	2	31	2	14	2	1	1	41
13	5	27	4	21	3	38	3	7	2	43	2	25	2	11	1	49
14	5	52	4	41	3	55	3	21	2	56	2	36	2	21	1	57
15	6	17	5	2	4	11	3	35	3	8	2	48	2	31	2	6
16	6	42	5	22	4	28	3	50	3	21	2	59	2	41	2	14
17	7	7	5	42	4	45	4	4	3	34	3	10	2	51	2	22
18	7	32	6	2	5	2	4	18	3	46	3	21	3	1	2	31
20	8	22	6	42	5	35	4	47	4	11	3	43	3	21	2	48

NUMBER OF REVOLUTIONS REQUIRED TO OBTAIN SURFACE SPEEDS OF FROM 20 FEET TO 60 FEET PER MINUTE ON DIAMETERS FROM 1 INCH TO 20 INCHES.

Copyrighted, Industrial Press, 1903.

Diam. Ins.	Circum. Ins.	Circum. Feet	Surface Speeds per Minute							
			20 Feet	25 Feet	30 Feet	35 Feet	40 Feet	45 Feet	50 Feet	60 Feet
1	3.1416	0.261	76.397	95.493	114.590	133.690	152.789	171.887	190.986	229.182
2	6.2832	0.523	38.197	47.746	57.296	66.845	76.394	85.944	95.493	114.590
3	9.4248	0.785	25.465	31.831	38.197	44.563	50.929	57.296	63.662	76.394
4	12.5664	1.047	19.099	23.873	28.647	33.422	38.197	42.971	47.746	57.296
5	15.7080	1.309	15.279	19.098	22.918	26.738	30.557	34.377	38.197	45.836
6	18.850	1.570	12.732	15.915	19.098	22.281	25.465	28.648	31.831	38.197
7	21.991	1.832	11.167	13.641	16.370	19.098	21.826	24.555	27.283	32.740
8	25.133	2.094	9.55	11.936	14.324	16.711	19.098	21.486	23.873	28.647
9	28.274	2.356	8.49	10.610	12.732	14.854	16.976	19.098	21.220	25.464
10	31.416	2.618	7.64	9.55	11.459	13.369	15.278	17.188	19.098	22.918
11	34.558	2.879	6.94	8.68	10.417	12.100	13.889	15.626	17.362	20.834
12	37.699	3.141	6.37	7.96	9.55	11.083	12.732	14.324	15.915	19.098
13	40.841	3.403	5.88	7.35	8.81	10.283	11.753	13.222	14.691	17.629
14	43.982	3.665	5.47	6.82	8.19	9.55	11.167	12.277	13.641	16.370
15	47.124	3.927	5.09	6.37	7.64	8.91	10.185	11.459	12.732	15.278
16	50.265	4.188	4.77	5.97	7.16	8.36	9.55	10.743	11.936	14.324
17	53.407	4.450	4.49	5.62	6.74	7.86	8.99	10.018	11.234	13.481
18	56.549	4.712	4.24	5.31	6.36	7.43	8.49	9.55	10.610	12.732
19	59.690	4.974	4.02	4.91	6.03	7.04	8.04	9.05	10.028	12.062
20	62.832	5.236	3.82	4.77	5.73	6.68	7.64	8.59	9.55	11.459

WEIGHTS AND MEASURES

TROY WEIGHT

24 grains = 1 pwt.
20 pwts. = 1 ounce.
12 ounces = 1 pound.

Used for weighing gold, silver and jewels.

APOTHECARIES' WEIGHT

20 grains = 1 scruple.
3 scruples = 1 dram.
8 drams = 1 ounce.
12 ounces = 1 pound.

The ounce and pound in this are the same as in Troy weight.

AVOIRDUPOIS WEIGHT

27 11-32 grains = 1 dram.
16 drams = 1 ounce.
16 ounces = 1 pound.
25 pounds = 1 quarter.
4 quarters = 1 cwt.
2,000 lbs. = 1 short ton.
2,240 lbs. = 1 long ton.

DRY MEASURE

2 pints = 1 quart.
8 quarts = 1 peck.
4 pecks = 1 bushel.
36 bushels = 1 chaldron.

LIQUID MEASURE

4 gills = 1 pint.
2 pints = 1 quart.
4 quarts = 1 gallon.
1 gallon = 3.785 litres.
31⅓ gallons = 1 barrel.
2 barrels = 1 hogshead.
1 quart = 57.75 cu. ins.
1 gallon = 231 cu. ins.
1 imperial gal. = 277.274 cu. ins. = 4.543 litres.

The Standard Unit of Liquid Measure adopted by the United States Government is the Winchester wine gallon, which contains 231 cubic inches, and holds 8.339 lbs. avoirdupois of distilled water, at its maximum density weighed in air, the barometer being at 30 inches.

The Imperial gallon adopted by Great Britain contains 277.274 cubic inches, and equals 1.20032 United States gallons.

The following cylinders contain some of the measures noted, very closely:

	DIAMETER	HEIGHT
Gill, . . .	1¾ inches. . .	3 inches.
Pint, . .	3½ “ . .	3 “
Quart, . .	3½ “ . .	6 “
Gallon, . .	7 “ . .	6 “
8 Gallons, .	14 “ . .	12 “
10 Gallons, .	14 “ . .	15 “

(Continued on next page.)

WEIGHTS AND MEASURES—Continued.

LONG MEASURE

12 inches = 1 foot.
3 feet = 1 yard.
5½ yards = 1 rod.
40 rods = 1 furlong.
8 furlongs = 1 sta. m.
5,280 feet = 1 mile.
3 miles = 1 league.

SURVEYORS' MEASURE

7.92 inches = 1 link.
25 links = 1 rod.
4 rods = 1 chain.
10 square chains or 160 square rods = 1 acre.
640 acres = 1 square mile.
36 square miles (6 miles sq.) = 1 township.

CUBIC MEASURE

1,728 cubic in. = 1 cu. ft.
27 cubic ft. = 1 cubic yd.
128 cu. ft. = 1 cord (wood).
40 cu. ft. = 1 ton (shpg.).
2,150.42 cubic inches = 1 standard bushel.
268.8 cubic inches = 1 standard gallon.
1 cubic foot = about four-fifths of a bushel.

MARINERS' MEASURE

6 feet = 1 fathom.
120 fathoms = 1 cable length.
7½ cable lengths = 1 mile.
5,280 ft. = 1 stat. mile.
6,080 ft. = 1 naut. mile.

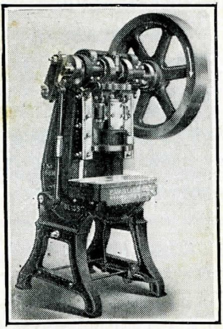
SQUARE MEASURE

144 sq. ins. = 1 sq. ft.
9 sq. ft. = 1 sq. yd.
30¼ sq. yds. = 1 sq. rod.
40 sq. rods = 1 rood.
4 roods = 1 acre.
640 acres = 1 sq.mile.
A township is 6 miles square = 36 sections.
A section is 1 mile square = 640 acres.
¼ section is ½ mile square = 160 acres.
1-16 section is ¼ mile square = 40 acres.

MISCELLANEOUS

3 inches = 1 palm.
4 inches = 1 hand.
6 inches = 1 span.
18 inches = 1 cubit.
21.8 in. = 1 Bible cubit.
2½ ft. = 1 military pace.

12 articles = 1 dozen.
12 dozen = 1 gross.
12 gross = 1 great gross.
2 articles = 1 pair.
20 articles = 1 score.
24 sheets = 1 quire.
20 quires = 1 ream.



"BLISS" DOUBLE-ACTION PRESSES—Built in 20 sizes, weighing from 750 to 32,000 lbs. Used in cutting and drawing shells in tin, brass, zinc, copper, aluminum and steel.

TO GEAR AN ENGINE LATHE TO CUT ANY PITCH

EXAMPLE:

To cut 1⅛" pitch = 8 threads to 9" } Ratio,
Lead screw, ⅕" pitch = 45 threads to 9" } 1 to 5⅝

Select a pair of gears, say 3 to 1, or 72 and 24.

72 on Stud }
24 on Screw } = 3 to 1. Now, 3 to 5⅝ = 24 to 45.

Arranged thus, cuts 1⅛" pitch:

Stud 72
Compound 24 and 45
24 Screw

RULE:

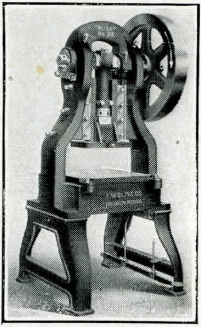
The ratio of the lead screw to the thread to be cut is the ratio of the gears.

Hence 8 and 45, or 16 and 90, or 24 and 135 teeth will cut 1⅛" pitch on the above lathe; but not being convenient to use the above gears, we divide 135 by 3, which gives 45 and 24 for the compound and any pair 3 to 1 to go on the screw and stud.

Different Standards for Wire Gauge in Use in the United States

Dimensions of Sizes in Decimal Parts of an Inch

No. of Wire Gauge	American or Brown & Sharpe	Birmingham or Stubs' Wire	Washburn & Moen Mfg. Co., Worcester, Mass.	Trenton Iron Co., Trenton, N. J.	Stubs' Steel Wire	U. S. Standard for Plate	No. of Wire Guage
000000	....	......	....	....	......	.46875	000000
00000	....	......	....	.45	......	.4375	00000
0000	.46	.454	.3938	.4	......	.40625	0000
000	.40964	.425	.3625	.36	......	.375	000
00	.3648	.38	.3310	.33	......	.34375	00
0	.32486	.34	.3065	.305	......	.3125	0
1	.2893	.3	.2830	.285	.227	.28125	1
2	.25763	.284	.2625	.265	.219	.265625	2
3	.22942	.259	.2437	.245	.212	.25	3
4	.20431	.238	.2253	.225	.207	.234375	4
5	.18194	.22	.2070	.205	.204	.21875	5
6	.16202	.203	.1920	.19	.201	.203125	6
7	.14428	.18	.1770	.175	.199	.1875	7
8	.12849	.165	.1620	.16	.197	.171875	8
9	.11443	.148	.1483	.145	.194	.15625	9
10	.10189	.134	.1350	.13	.191	.140625	10
11	.090742	.12	.1205	.1175	.188	.125	11
12	.080808	.109	.1055	.105	.185	.109375	12
13	.071961	.095	.0915	.0925	.182	.09375	13
14	.064084	.083	.0800	.08	.180	.078125	14
15	.057068	.072	.0720	.07	.178	.0703125	15
16	.05082	.065	.0625	.061	.175	.0625	16
17	.045257	.058	.0540	.0525	.172	.05625	17
18	.040303	.049	.0475	.045	.168	.05	18
19	.03589	.042	.0410	.04	.164	.04375	19
20	.031961	.035	.0348	.035	.161	.0375	20
21	.028462	.032	.03175	.031	.157	.034375	21
22	.025347	.028	.0286	.028	.155	.03125	22
23	.022571	.025	.0258	.025	.153	.028125	23
24	.0201	.022	.0230	.0225	151	.025	24
25	.0179	.02	.0204	.02	.148	.021875	25
26	.01594	.018	.0181	.018	.146	.01875	26
27	.014195	.016	.0173	.017	.143	.0171875	27
28	.012641	.014	.0162	.016	.139	.015625	28
29	011257	.013	0150	.015	.134	.0140625	29
30	.010025	.012	.0140	.014	.127	.0125	30
31	.008928	.01	.0132	.013	.120	.0109375	31
32	.00795	.009	.0128	.012	.115	.01015625	32
33	.00708	.008	.0118	.011	.112	.009375	33
34	.006304	.007	.0104	.01	.110	.00859375	34
35	.005614	.005	.0095	.0095	.108	.0078125	35
36	.005	.004	.0090	.009	.106	.00703125	36
37	.004453	......	......	.0085	.103	.006640625	37
38	.003965	......	......	.008	.101	.00625	38
39	.003531	......	......	.0075	.099	....	39
40	.003144	......	......	.007	.097	....	40



"BLISS" POWER PRESSES.—Nos. 29, 30 and 30 N, weighing from 3,000 to 5,400 lbs., also made with gearing. Adapted for many operations in the manufacture of pieced tinware, ironware, etc.

SHEET ZINC—M. & H. GAUGE

Inches	Inches	Inches
No. 1=0.002	No. 11=0.024	No. 21=0.080
" 2=0.004	" 12=0.028	" 22=0.090
" 3=0.006	" 13=0.032	" 23=0.100
" 4=0.008	" 14=0.036	" 24=0.125
" 5=0.010	" 15=0.040	" 25=0.250
" 6=0.012	" 16=0.045	" 26=0.375
" 7=0.014	" 17=0.050	" 27=0.500
" 8=0.016	" 18=0.055	" 28=1.000
" 9=0.018	" 19=0.060	
" 10=0.020	" 20=0.070	

AMERICAN RUSSIA IRON

No. 7 = .015 Inches	No. 12 = .021 Inches
" 8 = .016 "	" 13 = .024 "
" 9 = .017 "	" 14 = .025 "
" 10 = .018 "	" 15 = .027 "
" 11 = .020 "	" 16 = .030 "

STANDARD WEIGHTS AND GAUGES OF TIN PLATES

Trade term	56 lb.	60 lb.	65 lb.	70 lb.	75 lb.	80 lb.	85 lb.	90 lb.	95 lb.	100 lb.
Nearest wire gauge No	38	37	35	35	34	33	32	31	31	30½
Weight, sq. ft. lbs	.257	.275	.298	.322	.345	.367	.390	.413	.436	.459
Weight, box, 14x20, lbs	56	60	65	70	75	80	85	90	95	100

Trade term	IC	IXL	IX	IXX	IXXX	IXXXX	IXXXXX
Nearest wire gauge No	30	28	23	27	26	25	24
Weight, sq. ft., lbs	.491	.588	.619	.712	.803	.895	.987
Weight, box, 14x20, lbs	107	128	135	155	175	195	215

From American Sheet and Tin Plate Co.

NET WEIGHT PER

Trade term.............		80-lb.	85-lb.	90-lb.	95-lb.
Weight per box, lbs.		80	85	90	95
Size of Sheets	Sheets per box				
10 x 14	225	80	85	90	95
14 x 20	112	80	85	90	95
20 x 28	112	160	170	180	190
10 x 20	225	114	121	129	136
11 x 22	225	138	147	156	164
11½ x 23	225	151	161	170	179
12 x 12	225	82	87	93	98
12 x 24	112	82	87	93	98
13 x 13	225	97	103	109	115
13 x 26	112	97	103	109	115
14 x 14	225	112	119	126	133
14 x 28	112	112	119	126	133
15 x 15	225	129	137	145	153
16 x 16	225	146	155	165	174
17 x 17	225	165	175	186	196
18 x 18	112	93	98	104	110
19 x 19	112	103	110	116	122
20 x 20	112	114	121	129	136
21 x 21	112	126	134	142	150
22 x 22	112	138	147	156	164
23 x 23	112	151	161	170	179
24 x 24	112	164	175	185	195
26 x 26	112	193	205	217	229
16 x 20	112	91	97	103	109
14 x 31	112	124	132	140	147
11¼ x 22¾	112	73	78	82	87
13¼ x 17¾	112	67	71	76	80
13¼ x 19¼	112	73	77	82	87
13½ x 19½	112	75	80	85	89
13½ x 19¾	112	76	81	86	90
14 x 18¾	124	83	88	93	98
14 x 19¼	120	83	88	93	98
14 x 21	112	84	89	95	100
14 x 22	112	88	94	99	105
14 x 22¼	112	89	95	100	106
15½ x 23	112	102	108	115	121

From American Sheet and Tin Plate Co.

BOX TIN PLATES

100-lb.	IC	IXL	IX	IXX	IXXX	IXXXX
100	107	128	135	155	175	195
100	107	128	135	155	175	195
100	107	128	135	155	175	195
200	214	256	270	310	350	390
143	153	183	193	221	250	279
172	184	222	234	268	302	337
189	202	242	255	293	331	368
103	110	132	139	159	180	201
103	110	132	139	159	180	201
121	129	154	163	187	211	235
121	129	154	163	187	211	235
140	150	179	189	217	245	273
140	150	179	189	217	245	273
161	172	206	217	249	281	313
183	196	234	247	283	320	357
206	221	264	279	320	361	403
116	124	148	156	179	202	226
129	138	165	174	200	226	251
143	153	183	193	221	250	279
158	169	202	213	244	276	307
172	184	221	234	268	302	337
189	202	242	255	293	331	368
204	220	263	278	319	360	401
241	258	309	326	374	422	471
114	122	146	154	177	200	223
155	166	198	209	240	271	302
91	98	....	....	....	....	....
84	90	....	....	....	....	....
91	97	....	....	....	....	....
94	100	....	....	....	....	....
95	102	....	....	....	....	....
103	110	....	....	....	....	....
103	110	....	....	....	....	....
105	112	....	....	....	....	....
110	118	....	....	....	....	....
111	119	....	....	....	....	....
127	136	....	....	....	....	....

From American Sheet and Tin Plate Co

THE U. S.
For all Uncoated

Number of Gauge	Thickness in Fractions of an Inch	Thickness in Decimal Parts of an Inch	Thickness in Millimetres
0000000	1-2	.5	12.7
000000	15-32	.46875	11.90625
00000	7-16	.4375	11.1125
0000	13-32	.40625	10.31875
000	3-8	.375	9.525
00	11-32	.34375	8.73125
0	5-16	.3125	7.9375
1	9-32	.28125	7.14375
2	17-64	.265625	6.746875
3	1-4	.25	6.35
4	15-64	.234375	5.953125
5	7-32	.21875	5.55625
6	13-64	.203125	5.159375
7	3-16	.1875	4.7625
8	11-64	.171875	4.365625
9	5-32	.15625	3.96875
10	9-64	.140625	3.571875
11	1-8	.125	3.175
12	7-64	.109375	2.778125
13	3-32	.09375	2.38125
14	5-64	.078125	1.984375
15	9-128	.0703125	1.7859375
16	1-16	.0625	1.5875
17	9-160	.05625	1.42875
18	1-20	.05	1.27
19	7-160	.04375	1.11125
20	3-80	.0375	.9525
21	11-320	.034375	.873125
22	1-32	.03125	.79375
23	9-320	.028125	.714375
24	1-40	.025	.635
25	7-320	.021875	.555625
26	3-160	.01875	.47625
27	11-640	.0171875	.4365625
28	1-64	.015625	.396875
29	9-640	.0140625	.3571875
30	1-80	.0125	.3175
31	7-640	.0109375	.2778125
32	13-1280	.01015625	.25796875
33	3-320	.009375	.238125
34	11-1280	.00859375	.21828125
35	5-640	.0078125	.1984375
36	9-1280	.00703125	.17859375
37	17-2560	.006640625	.168671875
38	1-160	.00625	.15875

From American Sheet and Tin Plate Co.

STANDARD GAUGE
Sheets and Plates of Iron

Weight per Sq. Ft. in Oz.	Weight per Sq. Foot in Lbs.	Weight per Sq. Ft. in Kilo.	Weight per Sq. Meter in Kilo.	Weight per Sq. Meter in Lbs.
320	20.	9.072	97.65	215.28
300	18.75	8.505	91.55	201.82
280	17.50	7.983	85.44	188.37
260	16.25	7.371	79.33	174.91
240	15.	6.804	73.24	161.46
220	13.75	6.237	67.13	148.00
200	12.50	5.67	61.03	134.55
180	11.25	5.103	54.93	121.09
170	10.625	4.819	51.88	114.37
160	10.	4.536	48.82	107.64
150	9.375	4.252	45.77	100.91
140	8.75	3.969	42.72	94.18
130	8.125	3.685	39.67	87.45
120	7.5	3.402	36.62	80.72
110	6.875	3.118	33.57	74.00
100	6.25	2.835	30.52	67.27
90	5.625	2.552	27.46	60.55
80	5.	2.268	24.41	53.82
70	4.375	1.984	21.36	47.09
60	3.75	1.701	18.31	40.36
50	3.125	1.417	15.26	33.64
45	2.8125	1.276	13.73	30.27
40	2.5	1.134	12.21	26.91
36	2.25	1.021	10.99	24.22
32	2.	.9072	9.765	21.53
28	1.75	.7983	8.544	18.84
24	1.50	.6804	7.324	16.15
22	1.375	.6237	6.713	14.80
20	1.25	.567	6.103	13.46
18	1.125	.5103	5.493	12.11
16	1.	.4536	4.882	10.76
14	.875	.3969	4.272	9.42
12	.75	.3402	3.662	8.07
11	.6875	.3119	3.357	7.40
10	.625	.2835	3.052	6.73
9	.5625	.2551	2.746	6.05
8	.5	.2268	2.441	5.38
7	.4375	.1984	2.136	4.71
6½	.40625	.1843	1.983	4.37
6	.375	.1701	1.831	4.04
5½	.34375	.1559	1.678	3.70
5	.3125	.1417	1.526	3.36
4½	.28125	.1276	1.373	3.03
4¼	.265625	.1205	1.297	2.87
4	.25	.1134	1.221	2.69

From American Sheet and Tin Plate Co.

BUNDLING TABLE

Table of Standard Sizes showing Weights of Number of Sheets

24 Inches

U. S. Std. Gauge	72 In. Long			84 In. Long			96 In. Long		
	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle
10	67.5	2	135	78.75	2	157	90.	2	180
11	60.	3	180	70.	2	140	80.	2	160
12	52.5	3	157	61.25	2	122	70.	2	140
13	45.	3	135	52.5	3	157	60.	2	120
14	37.5	4	150	43.75	3	131	50.	3	150
15	33.75	4	135	39.38	4	157	45.	3	135
16	30.	5	150	35.	4	140	40.	4	160
17	27.	6	162	31.5	5	157	36.	4	144
18	24.	6	144	28.	5	140	32.	5	160
19	21.	7	147	24.5	6	147	28.	5	140
20	18.	8	144	21.	7	147	24.	6	144
21	16.5	9	148	19.25	8	154	22.	7	154
22	15.	10	150	17.5	8	140	20.	7	140
23	13.5	11	148	15.75	9	142	18.	8	144
24	12.	12	144	14.	11	154	16.	9	144
25	10.5	14	147	12.25	12	147	14.	10	140
26	9.	16	144	10.5	14	147	12.	12	144
27	8.25	18	148	9.63	15	144	11.	13	143
28	7.5	20	150	8.75	17	149	10.	15	150
29	6.75	22	148	7.88	19	150	9.	16	144
30	6.	25	150	7.	21	147	8.	18	144

From American Sheet and Tin Plate Co.

OF BLACK SHEETS

Sheets and Bundles (without bands) and in One Bundle

Wide

101 In. Long			108 In. Long			120 In. Long				
Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	U. S. Std. Gauge	Weight of One Band
94.69			101.25			112.5			10	.918
84.17	2	168	90.	2	180	100.			11	
73.65	2	147	78.75	2	157	87.5	2	175	12	
63.13	2	126	67.5	2	135	75.	2	150	13	
52.6	3	158	56.25	3	169	62.5	2	125	14	
47.34	3	142	50.63	3	152	56.25	3	169	15	
42.08	4	168	45.	3	135	50.	3	150	16	
37.88	4	151	40.5	4	162	45.	3	135	17	
33.67	4	135	36.	4	144	40.	4	160	18	
29.46	5	147	31.5	5	157	35.	4	140	19	
25.25	6	151	27.	5	135	30.	5	150	20	
23.15	6	139	24.75	6	148	27.5	5	137	21	
21.04	7	147	22.5	7	157	25.	6	150	22	
18.94	8	151	20.25	7	142	22.5	7	157	23	
16.83	9	151	18.	8	144	20.	7	140	24	
14.73	10	147	15.75	9	142	17.5	8	140	25	
12.63	12	151	13.5	11	148	15.	10	150	26	
11.57	12	139	12.38	12	148	13.75	11	151	27	
10.52	14	147	11.25	13	146	12.5	12	150	28	
9.47	16	151	10.13	15	152	11.25	13	146	29	
8.42	18	151	9.	17	153	10.	15	150	30	

From American Sheet and Tin Plate Co.

BUNDLING TABLE

Table of Standard Sizes showing Weights of Number of Sheets

26 Inches

U. S. Std. Gauge	72 In. Long			84 In. Long			96 In. Long		
	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle
10	73.13	2	146	85.31	2	171	97.5	2	195
11	65.	2	130	75.83	2	152	86.67	2	173
12	56.88	3	171	66.35	2	133	75.83	2	152
13	48.75	3	146	56.88	3	171	65.	2	130
14	40.63	4	162	47.4	3	142	54.17	3	162
15	36.56	4	146	42.66	3	128	48.75	3	146
16	32.5	5	162	37.92	4	152	43.33	3	130
17	29.25	5	146	34.13	4	136	39.	4	156
18	26.	6	156	30.33	5	152	34.67	4	139
19	22.75	7	159	26.54	6	159	30.33	5	152
20	19.5	8	156	22.75	7	159	26.	6	156
21	17.88	8	143	20.85	7	146	23.83	6	143
22	16.25	9	146	18.96	8	152	21.67	7	152
23	14.63	10	146	17.06	9	153	19.5	8	156
24	13.	11	143	15.16	10	152	17.33	9	156
25	11.38	13	148	13.27	11	146	15.17	10	152
26	9.75	15	146	11.38	13	148	13.	11	143
27	8.94	16	143	10.43	14	146	11.92	12	143
28	8.13	18	146	9.48	16	152	10.83	14	152
29	7.31	20	146	8.53	17	145	9.75	15	146
30	6.5	23	149	7.58	19	144	8.67	17	147

From American Sheet and Tin Plate Co.

OF BLACK SHEETS

Sheets and Bundles (without bands) and in One Bundle

Wide

101 In. Long			108 In. Long			120 In. Long				
Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	U. S. Std. Gauge	Weight of One Band
102.58			109.69			121.88			10	.986
91.18	2	182	97.5	2	195	108.33			11	
79.78	2	159	85.31	2	171	94.79	2	198	12	
68.39	2	137	73.13	2	146	81.25	2	162	13	
57.	3	171	60.94	2	122	67.71	2	135	14	
51.29	3	154	54.84	3	164	60.94	2	122	15	
45.59	3	137	48.75	3	146	54.17	3	162	16	
41.03	4	164	43.88	3	132	48.75	3	146	17	
36.47	4	146	39.	4	156	43.33	3	130	18	
31.92	5	160	34.13	4	136	37.92	4	152	19	
27.35	5	137	29.25	5	146	32.5	5	162	20	
25.08	6	150	26.81	6	161	29.79	5	149	21	
22.79	7	159	24.37	6	146	27.08	6	162	22	
20.51	7	143	21.94	7	153	24.37	6	146	23	
18.24	8	146	19.5	8	156	21.67	7	152	24	
15.96	9	144	17.06	9	153	18.96	8	152	25	
13.68	11	150	14.63	10	146	16 25	9	146	26	
12.54	12	150	13.41	11	147	14.9	10	149	27	
11.4	13	148	12 19	12	146	13.54	11	149	28	
10.26	14	144	10.97	14	153	12.19	12	146	29	
9.12	16	146	9.75	15	146	10.83	14	152	30	

BUNDLING TABLE

Table of Standard Sizes showing Weights of Number of Sheets

30 Inches

U. S. Std. Gauge	72 In. Long			84 In. Long			96 In. Long		
	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle
10	84.38	2	169	98.44			112.5		
11	75.	2	150	87.5	2	175	100.		
12	65.63	2	131	76.56	2	153	87.5	2	175
13	56.25	3	169	65.63	2	131	75.	2	150
14	46.88	3	141	54.69	3	164	62.5	2	125
15	42.19	4	169	49.22	3	148	56.25	3	169
16	37.5	4	150	43.75	3	131	50.	3	150
17	33.75	4	135	39.38	4	157	45.	3	135
18	30.	5	150	35.	4	140	40.	4	160
19	26.25	6	157	30.63	5	153	35.	4	140
20	22.5	7	157	26.25	6	157	30.	5	150
21	20.63	7	144	24.06	6	144	27.5	6	165
22	18.75	8	150	21.88	7	153	25.	6	150
23	16.88	9	152	19.69	8	157	22.5	7	157
24	15.	10	150	17.5	8	140	20.	7	140
25	13.13	11	144	15.31	10	153	17.5	8	140
26	11.25	13	146	13.13	11	144	15.	10	150
27	10.31	14	144	12.03	12	144	13.75	11	151
28	9.38	16	150	10.94	14	153	12.5	12	150
29	8.44	18	152	9.84	15	148	11.25	13	146
30	7.5	20	150	8.75	17	149	10.	15	150

From American Sheet and Tin Plate Co.

OF BLACK SHEETS

Sheets and Bundles (without bands) and in One Bundle

Wide

101 In. Long			108 In. Long			120 In. Long			U. S. Std. Gauge	Weight of One Band
Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle		
118.36			126.56			140.63			10	1.122
105.21			112.5			125.			11	
92.06	2	184	98.44			109.38			12	
78.91	2	158	84.38	2	169	93.75	2	187	13	
65.76	2	131	70.31	2	141	78.13	2	156	14	
59.18	2	118	63.28	2	126	70.31	2	141	15	
52.6	3	158	56.25	3	169	62.5	2	125	16	
47.34	3	142	50.63	3	152	56.25	3	169	17	
42.08	4	168	45.	3	135	50.	3	150	18	
36.83	4	147	39.38	4	157	43.75	3	131	19	
31.56	5	158	33.75	4	135	37.5	4	150	20	
28.94	5	145	30.94	5	155	34.37	4	137	21	
26.3	6	158	28.12	5	141	31.25	5	156	22	
23.67	6	142	25.31	6	152	28.12	5	141	23	
21.04	7	147	22.5	7	157	25.	6	150	24	
18.41	8	147	19.69	8	157	21.88	7	153	25	
15.78	9	142	16.88	9	152	18.75	8	150	26	
14.47	10	145	15.47	10	155	17.19	9	155	27	
13.15	11	145	14.06	11	155	15.63	10	156	28	
11.84	12	142	12.66	12	152	14.06	11	155	29	
10.52	14	147	11.25	13	146	12.5	12	150	30	

From American Sheet and Tin Plate Co.

BUNDLING TABLE

Table of Standard Sizes showing Weights of Number of Sheets

36 Inches

U. S. Std. Gauge	72 In. Long			84 In. Long			96 In. Long		
	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle
10	101.25			118.13			135.		
11	90.	2	180	105.			120.		
12	78.75	2	157	91.88	2	184	105.		
13	67.5	2	135	78.75	2	157	90.	2	180
14	56.25	3	169	65.63	2	131	75.	2	150
15	50.63	3	152	59.06	2	118	67.5	2	135
16	45.	3	135	52.5	3	157	60.	2	120
17	40.5	4	162	47.25	3	142	54.	3	162
18	36.	4	144	42.	4	168	48.	3	144
19	31.5	5	157	36.75	4	147	42.	4	168
20	27.	5	135	31.5	5	157	36.	4	144
21	24.75	6	148	28.88	5	144	33.	5	165
22	22.5	7	157	26.25	6	157	30.	5	150
23	20.25	7	142	23.63	6	142	27.	6	162
24	18.	8	144	21.	7	147	24.	6	144
25	15.75	9	142	18.38	8	147	21.	7	147
26	13.5	11	148	15.75	9	142	18.	8	144
27	12.38	12	148	14.44	10	144	16.5	9	148
28	11.25	13	146	13.13	11	144	15.	10	150
29	10.13	15	152	11.81	13	153	13.5	11	148
30	9.	16	144	10.5	14	147	12.	12	144

From American Sheet and Tin Plate Co.

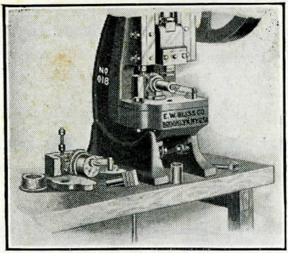
OF BLACK SHEETS

Sheets and Bundles (without bands) and in One Bundle

Wide

101 In. Long			108 In. Long			120 In. Long				
Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	Weight per Sheet	No. of Sheets	Weight per Bundle	U. S. Std. Gauge	Weight of One Band
142.03			151.88			168.75			10	1.224
126.25			135.			150.			11	
110.47			118.13			131.25			12	
94.69	2	189	101.25			112.5			13	
78.91	2	158	84.38	2	169	93.75	2	187	14	
71.01	2	142	75.94	2	152	84.38	2	169	15	
63.13	2	126	67.5	2	135	75.	2	150	16	
56.81	3	170	60.75	2	121	67.5	2	135	17	
50.5	3	151	54.	3	162	60.	2	120	18	
44.19	3	132	47.25	3	142	52.5	3	157	19	
37.88	4	151	40.5	4	162	45.	3	135	20	
34.72	4	139	37.13	4	148	41.25	4	165	21	
31.56	5	158	33.75	5	169	37.5	4	150	22	
28.41	5	142	30.38	5	152	33.75	5	169	23	
25.25	6	151	27.	6	162	30.	5	150	24	
22.1	7	155	23.63	6	142	26.25	6	157	25	
18.94	8	151	20.25	7	142	22.5	7	157	26	
17.36	9	156	18.56	8	148	20.63	8	165	27	
15.78	9	142	16.88	9	152	18.75	8	150	28	
14.2	10	142	15.19	10	152	16.88	9	152	29	
12.62	12	151	13.5	11	148	15.	10	150	30	

From American Sheet and Tin Plate Co.



"BLISS" BENCH POWER PRESS, No. 018
With Automatic Perforating Attachments

The Perforating Attachments on press illustrated above represents two of the many perforating devices made for sheet-metal shells of various shapes.

TO FIND THE CAPACITY OF A TANK IN GALLONS

First step (all measurements to be in inches):

For rectangular tanks, multiply the length by the width, by the depth.

For cylindrical tanks, multiply the length by the square of the diameter, by .7854.

For elliptical section tanks, multiply the length by the short diameter, by the long diameter, by .0339.

Second step:

Divide the result by 231, which is the number of cubic inches in one gallon; the answer is the capacity of the tank in gallons.

TO CEMENT EMERY CLOTH ON A POLISHING DISC

Apply an even coat of medium thick brown shellac to the surface of the disc, put the emery cloth on the disc and apply an even pressure on the whole surface of disc until thoroughly dry.

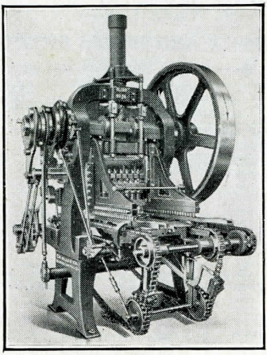
Weight of COPPER AND BRASS SHEETS

Brown and Sharpe's Gauge

No.	Thickness Inches		Lbs. per Sq. Ft.	
	Decimal Equivalent	Nearest Fraction	Copper	Brass
0000	.4600	29/64+	21.30	20.37
000	.4096	13/32	18.97	18.14
00	.3648	23/64+	16.89	16.15
0	.3249	21/64	15.04	14.39
1	.2893	19/64−	13.39	12.81
2	.2576	1/4+	11.93	11.41
3	.2294	15/64−	10.62	10.16
4	.2043	13/64	9.460	9.047
5	.1819	3/16−	8.424	8.057
6	.1620	5/32+	7.502	7.175
7	.1443	9/64+	6.681	6.389
8	.1285	1/8+	5.949	5.690
9	.1144	7/64+	5.298	5.067
10	.1019	7/64	4.718	4.512
11	.09074	3/32	4.201	4.018
12	.08081	5/64+	3.741	3.578
13	.07196	5/64−	3.332	3.187
14	.06408	1/16+	2.967	2.838
15	.05707	1/16−	2.642	2.527
16	.05082	3/64+	2.353	2.251
17	.04526	3/64−	2.096	2.004
18	.04030		1.866	1.785
19	.03589		1.662	1.589
20	.03196	1/32+	1.480	1.415
21	.02846	1/32−	1.318	1.260
22	.02535		1.174	1.122
23	.02257		1.045	.9995
24	.02010		.9307	.8901
25	.01790		.8288	.7927
26	.01594	1/64+	.7381	.7059
27	.01420	1/64−	.6573	.6286
28	.01264		.5853	.5598
29	.01126		.5212	.4985
30	.01003		.4642	.4439
31	.008928		.4134	.3953
32	.007950		.3681	.3521
33	.007080		.3278	.3135
34	.006305		.2919	.2792
35	.005615		.2600	.2486
36	.005000		.2315	.2214
37	.004453		.2062	.1972
38	.003965		.1836	.1756
39	.003531		.1635	.1564
40	.003145		.1456	.1393

The + sign shows that the size is more than 1 per cent. full.
The — sign shows that the size is more than 1 per cent. scant.
Variations from these weights must be expected in practice.

From The American Brass Co.



"BLISS" DOUBLE-ACTION GANG PRESSES.—Built in a number of sizes. Weights 5,500 to 15,500 lbs. Adapted for cutting, drawing and stamping a considerable number of small shells at each stroke. Machine illustrated produces 14 bottle-caps at each stroke.

TABLE SHOWING THE ORDER OF

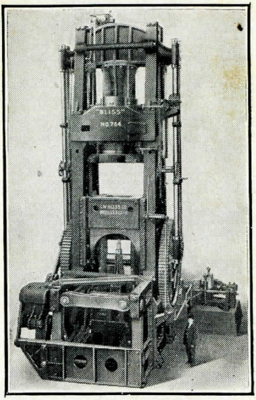
Malleability	Ductility	Tenacity	Infusibility
Gold	Platinum	Iron	Platinum
Silver	Silver	Copper	Iron
Aluminum	Iron	Aluminum	Copper
Copper	Copper	Platinum	Gold
Tin	Gold	Silver	Silver
Lead	Aluminum	Zinc	Aluminum
Zinc	Zinc	Gold	Zinc
Platinum	Tin	Tin	Lead
Iron	Lead	Lead	Tin

Thickness of STANDARD COPPER SHEETS Rolled to Weight

Weight per Sq. Ft.		Thickness	Nearest Gauge No.		Nearest Fraction
Ounces	Pounds	Inches	B. & S.	Stubs	
	16	.3456	00	00	11/32
	15	.3240	0	0	21/64+
	14	.3024	1	1	19/64−
	13	.2808	1	2	9/32
	12	.2592	2	3	1/4−
	11	.2376	3	4	15/64−
	10	.2160	4	5	7/32+
	9½	.2052	4	6	13/64
	9	.1944	4	6	
	8½	.1836	5	7	3/16+
	8	.1728	5	8	11/64
	7½	.1620	6	8	
	7	.1512	7	9	5/32+
	6½	.1404	7	10	9/64
	6	.1296	8	10	1/8−
	5½	.1188	9	11	
80	5	.1080	10	12	7/64+
72	4½	.0972	10	13	3/32−
64	4	.0864	11	14	
56	3½	.0756	13	15	5/64+
48	3	.0648	14	16	1/16−
44	2¾	.0594	15	17	
40	2½	.0540	15	17	
36	2¼	.0486	16	18	3/64−
32	2	.0432	17	19	
28	1¾	.0378	19	20	
24	1½	.0324	20	21	1/32−
20	1¼	.0270	21	22	
18	1⅛	.0243	22	23	
16	1	.0216	23	24	
14	⅞	.0189	25	26	
12	¾	.0162	26	27	1/64−
10	⅝	.0135	27	29	
8	½	.0108	29	31	
6	⅜	.0081	32	33	
4	¼	.0054	35	35	
2	⅛	.0027			

The + sign shows that the size is more than 1 per cent. full.
The − sign shows that the size is more than 1 per cent. scant.
Variations from these weights must be expected in practice.

From The American Brass Co.



"BLISS" BOTTOM SLIDE DRAWING PRESS—Will draw blank 64″ diameter of 3/16″ soft steel. Largest punch diameter 48″. Will draw in depth 45″. Weight 620,000 lbs.

RULES RELATIVE TO THE CIRCLE

To Find Circumference—
Multiply diameter by 3.1416.
Or divide diameter by 0.3183.

To Find Diameter—
Multiply circumference by 0.3183.
Or divide circumference by 3.1416.

To Find Radius—
Multiply circumference by 0.15915.
Or divide circumference by 6.28318.

To Find Side of an Inscribed Square—
Multiply diameter by 0.7071.
Or multiply circumference by 0.2251.
Or divide circumference by 4.4428.

(Continued on next page)

RULES RELATIVE TO THE CIRCLE—
Continued

To Find Side of a Square of Equal Area—

Multiply diameter by 0.8862.
Or divide diameter by 1.1284.
Or multiply circumference by 0.2821.
Or divide circumference by 3.545.

Square—

A side multiplied by 1.4142 equals diameter of its circumscribing circle.

A side multiplied by 4.443 equals circumference of its circumscribing circle.

A side multiplied by 1.1284 equals diameter of a circle of equal area.

A side multiplied by 3.545 equals circumference of an equal circle.

To Find the Area of a Circle–

(See Table, pages 56 and 57)

Multiply circumference by one-quarter of the diameter.

Or multiply the square of diameter by 0.7854.

Or multiply the square of circumference by 0.07958.

Or multiply the square of one-half diameter by 3.1416.

To Find the Area of an Ellipse—

Multiply the product of its axis by .7854.

Or multiply the product of its semi-axis by 3.14159.

Contents of cylinder = area of end × length.

Contents of wedge = area triangular base × altitude.

Surface of cylinder = length × circumference + area of both ends.

Surface of sphere = diameter squared × 3.1416, or = diameter × circumference.

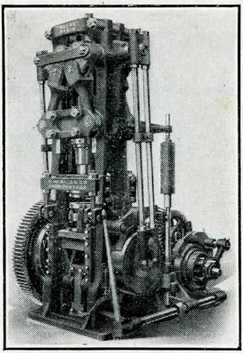
Contents of sphere × diameter cubed × 0.5236.

Contents of pyramid or cone, right or oblique, regular or irregular = area of base × one-third altitude.

Area of triangle = base × one-half altitude.

Area of parallelogram = base × altitude.

Area of trapezoid = altitude × one-half the sum of parallel sides.



"BLISS" TWO-STEP TOGGLE DRAWING PRESSES—Built in 5 sizes and 2 styles. For drawing and re-drawing shells from all kinds of sheet metal, performs two operations in one. Weights, 18,000 to 70,000 lbs.

CIRCUMFERENCES AND AREAS OF CIRCLES

Diam.	Circ.	Area	Diam.	Circ.	Area
1/8	.3926	.01227	1 5/8	5.105	2.073
1/4	.7854	.04908	3/4	5.497	2.405
3/8	1.178	.1104		5.890	2.761
1/2	1.570	.1963	2	6.283	3.141
5/8	1.963	.3067		6.675	3.546
3/4	2.356	.4417	1/4	7.068	3.976
7/8	2.748	.6013		7.461	4.130
1	3.141	.7854	1/2	7.854	4.908
	3.534	.9940		8.246	5.411
1/4	3.927	1.227	3/4	8.639	5.939
	4.319	1.484		9.032	6.491
1/2	4.712	1.767	3	9.424	7.068

(Continued on next page)

CIRCUMFERENCES AND AREAS OF CIRCLES—Continued

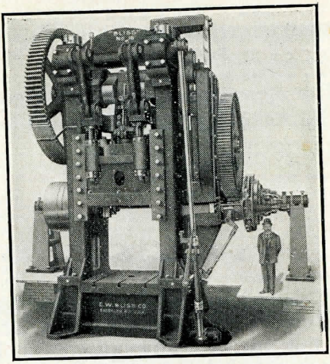
Diam.	Circ.	Area	Diam.	Circ.	Area
3 ⅛	9.817	7.669	9 ⅛	28.66	65.396
¼	10.21	8.295	¼	29.05	67.200
	10.60	8.946		29.45	69.029
½	10.99	9.621	½	29.84	70.882
	11.38	10.320		30.23	72.759
¾	11.78	11.044	¾	30.63	74.662
	12.17	11.793		31.02	76.588
4	12.56	12.566	10	31.41	78.539
	12.95	13.364		31.80	80.515
¼	13.35	14.186	¼	32.20	82.516
	13.74	15.033		32.59	84.540
½	14.13	15.904	½	32.98	86.590
	14.52	16.800		33.37	88.664
¾	14.92	17.720	¾	33.77	90.762
	15.31	18.665		34.16	92.885
5	15.70	19.635	11	34.55	95.033
	16.10	20.629		34.95	97.205
¼	16.49	21.647	¼	35.34	99.402
	16.88	22.690		35.73	101.62
½	17.27	23.758	½	36.12	103.86
	17.67	24.850		36.52	106.13
¾	18.06	25.967	¾	36.91	108.43
	18.45	27.108		37.30	110.75
6	18.84	28.274	12	37.69	113.09
	19.24	29.464		38.09	115.46
¼	19.63	30.679	¼	38.48	117.85
	20.02	31.919		38.87	120.27
½	20.42	33.183	½	39.27	122.71
	20.81	34.471		39.66	125.18
¾	21.20	35.784	¾	40.05	127.67
	21.57	37.122		40.44	130.19
7	21.99	38.484	13	40.84	132.73
	22.38	39.871		41.23	135.29
¼	22.77	41.282	¼	41.62	137.88
	23.16	42.718		42.01	140.50
½	23.56	44.178	½	42.41	143.13
	23.95	45.663		42.80	145.80
¾	24.34	47.173	¾	43.19	148.48
	24.74	48.707		43.58	151.20
8	25.13	50.265	14	43.98	153.93
	25.52	51.848	¼	44.76	159.48
¼	25.91	53.456	½	45.55	165.13
	26.31	55.088	¾	46.33	170.87
½	26.70	56.745	15	47.12	176.71
	27.09	58.426	¼	47.90	182.65
¾	27.48	60.132	½	48.69	188.69
	27.88	61.862	¾	49.48	194.82
9	28.27	63.617	16	50.26	201.06

AREA OF CIRCLES—IN SQUARE FEET

Diameter	0 in.	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.
0 ft.	.0000	.0055	.0218	.0491	.0873	.1364	.1964	.2670	.3491	.4418	.5454	.6600
1 "	.7854	.922	1.07	1.23	1.40	1.58	1.77	1.97	2.18	2.41	2.64	2.89
2 "	3.14	3.41	3.69	3.98	4.28	4.59	4.91	5.24	5.59	5.94	6.30	6.68
3 "	7.07	7.47	7.88	8.30	8.73	9.17	9.62	10.08	10.56	11.04	11.54	12.05
4 "	12.57	13.10	13.64	14.19	14.75	15.32	15.90	16.50	17.10	17.72	18.35	18.99
5 ft.	19.64	20.29	20.97	21.65	22.34	23.04	23.76	24.48	25.20	25.97	26.73	27.49
6 "	28.27	29.07	29.87	30.68	31.50	32.34	33.18	34.04	34.91	35.78	36.67	37.57
7 "	38.48	39.41	40.34	41.28	42.24	43.20	44.18	45.17	46.16	47.17	48.19	49.22
8 "	50.27	51.32	52.38	53.46	54.54	55.64	56.75	57.86	58.99	60.13	61.28	62.44
9 "	63.62	64.80	66.00	67.20	68.42	69.64	70.88	72.13	73.39	74.66	75.94	77.24
10 "	78.54	79.85	81.18	82.52	83.86	85.22	86.59	87.97	89.36	90.76	92.18	93.60

NOTE: To find the area of a given circle use the figures at the intersection of the columns (representing feet and inches) which, when combined, equal the diameter of the circle.

From The American Brass Co.



"BLISS" TOGGLE DRAWING PRESSES— Built in over 20 sizes, weighing from 5,600 to 165,000 lbs. For drawing shells from all kinds of sheet metal.

RULE TO FIND DIAMETER OF BLANK FOR SEAMLESS DRAWN SHELL

Multiply circumference by height, add area of bottom, which gives area of blank. Then find diameter of circle, whose area is equal to area found.

EXAMPLE.—What is area of blank for shell 3 in. diam. x 2 in. high?

3.1416
3 Diameter
9.4248
2 Height
18.8496 Area of Sides
7.068 Area of Bottom
25.9176 Total Area = 5.75 in.
Diam. of Blank.

NOTE.—For area of circle, see pages 56 and 57. For approximate diameter of blanks for shells, see pages 60 to 75.

APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

The approximate blank sizes given on the following pages are figured from the formula:

$$D=\sqrt{d^2+4dh}$$

D=dia. of blank. d=dia. of shell.
h=height of shell.

It should be noted that the blank sizes given are approximate only. They do not include any allowance for stretch of metal and are figured without reference to thickness of metal, and are based on using "Bliss" standard die construction. Shells are figured with sharp corners in the bottom. Diameter of shell should be taken from center of thickness of side walls. Sizes of blanks for shells vary according to the varying conditions of die construction; such as fit of die and punch in relation to each other, the size of drawing corner on the die or punch or amount of pressure on blank holding surfaces. The character of metal, whether sheet steel, brass, copper, aluminum, nickel, zinc, silver or gold, and its qualities as regards hardness or softness also have a determining influence.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From ¼″ dia. x ½″ high to 1⅞″ dia. x 2¼″ high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	
¼	.75	.83	.90	.97	1.03	1.09	1.15	1.20	1.25	1.30	1.34	1.39	1.43	1.52	¼
⅜	.94	1.04	1.13	1.21	1.28	1.34	1.42	1.48	1.55	1.61	1.67	1.71	1.78	1.88	⅜
½	1.12	1.22	1.32	1.41	1.50	1.58	1.66	1.73	1.80	1.87	1.93	2.00	2.07	2.18	½
⅝	1.28	1.40	1.50	1.60	1.70	1.79	1.88	1.96	2.04	2.11	2.19	2.26	2.32	2.46	⅝
¾	1.44	1.56	1.67	1.78	1.89	1.98	2.08	2.16	2.25	2.33	2.41	2.48	2.56	2.70	¾
⅞	1.59	1.72	1.84	1.95	2.06	2.16	2.26	2.36	2.45	2.54	2.62	2.70	2.78	2.94	⅞
1	1.73	1.87	2.00	2.12	2.23	2.34	2.45	2.55	2.64	2.74	2.82	2.91	3.00	3.16	1
1⅛	1.87	2.02	2.15	2.28	2.40	2.51	2.62	2.73	2.83	2.93	3.02	3.11	3.21	3.37	1⅛
1¼	2.01	2.16	2.30	2.43	2.56	2.68	2.80	2.90	3.01	3.11	3.22	3.31	3.40	3.58	1¼
1⅜	2.16	2.31	2.45	2.59	2.72	2.84	2.96	3.08	3.18	3.29	3.39	3.49	3.59	3.77	1⅜
1½	2.29	2.45	2.60	2.74	2.87	3.00	3.12	3.24	3.36	3.46	3.58	3.67	3.77	3.97	1½
1⅝	2.42	2.59	2.74	2.89	3.02	3.15	3.28	3.40	3.52	3.63	3.74	3.85	3.95	4.15	1⅝
1¾	2.56	2.72	2.88	3.03	3.17	3.30	3.43	3.56	3.68	3.80	3.91	4.03	4.14	4.34	1¾
1⅞	2.70	2.86	3.02	3.18	3.32	3.46	3.59	3.72	3.84	3.97	4.08	4.20	4.30	4.52	1⅞

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 2″ dia. x ½″ high to 3⅝″ dia. x 2¼″ high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	
2	2.83	3.00	3.16	3.31	3.46	3.61	3.75	3.87	4.00	4.12	4.24	4.36	4.47	4.69	2
2⅛	2.96	3.13	3.30	3.46	3.61	3.75	3.89	4.02	4.16	4.28	4.40	4.52	4.64	4.86	2⅛
2¼	3.09	3.27	3.44	3.60	3.75	3.90	4.04	4.18	4.31	4.44	4.56	4.68	4.80	5.03	2¼
2⅜	3.22	3.40	3.57	3.74	3.89	4.04	4.18	4.32	4.46	4.59	4.72	4.84	4.96	5.20	2⅜
2½	3.35	3.54	3.71	3.87	4.03	4.18	4.33	4.47	4.61	4.74	4.87	5.00	5.12	5.36	2½
2⅝	3.48	3.67	3.84	4.01	4.17	4.32	4.47	4.62	4.76	4.89	5.03	5.15	5.28	5.52	2⅝
2¾	3.61	3.80	3.98	4.15	4.31	4.47	4.62	4.76	4.90	5.04	5.18	5.31	5.44	5.68	2¾
2⅞	3.75	3.93	4.11	4.28	4.45	4.60	4.76	4.91	5.05	5.19	5.33	5.46	5.59	5.84	2⅞
3	3.87	4.06	4.24	4.42	4.58	4.74	4.90	5.05	5.20	5.34	5.48	5.61	5.74	6.00	3
3⅛	4.00	4.19	4.38	4.55	4.72	4.88	5.04	5.19	5.34	5.48	5.63	5.76	5.90	6.16	3⅛
3¼	4.13	4.32	4.51	4.68	4.85	5.02	5.18	5.33	5.48	5.63	5.77	5.91	6.05	6.31	3¼
3⅜	4.26	4.45	4.64	4.82	4.99	5.15	5.31	5.47	5.62	5.77	5.92	6.05	6.19	6.47	3⅜
3½	4.39	4.58	4.77	4.95	5.12	5.29	5.45	5.61	5.77	5.91	6.06	6.20	6.35	6.61	3½
3⅝	4.51	4.71	4.90	5.08	5.26	5.43	5.59	5.75	5.90	6.06	6.21	6.35	6.49	6.76	3⅝

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 3¾" dia. x ½" high to 5⅜" dia. x 2¼" high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	
3¾	4.64	4.84	5.03	5.21	5.39	5.56	5.73	5.89	6.04	6.20	6.35	6.49	6.63	6.91	3¾
3⅞	4.77	4.97	5.16	5.34	5.52	5.69	5.86	6.02	6.18	6.34	6.49	6.64	6.78	7.06	3⅞
4	4.90	5.10	5.29	5.48	5.66	5.83	6.00	6.16	6.32	6.48	6.63	6.78	6.92	7.21	4
4⅛	5.02	5.22	5.42	5.61	5.79	5.96	6.13	6.30	6.46	6.62	6.77	6.92	7.07	7.36	4⅛
4¼	5.15	5.35	5.55	5.74	5.92	6.09	6.27	6.43	6.60	6.76	6.91	7.06	7.21	7.50	4¼
4⅜	5.28	5.48	5.68	5.87	6.05	6.23	6.40	6.57	6.73	6.89	7.05	7.21	7.35	7.64	4⅜
4½	5.40	5.61	5.81	6.00	6.18	6.36	6.53	6.70	6.87	7.03	7.19	7.35	7.50	7.79	4½
4⅝	5.53	5.74	5.93	6.13	6.31	6.49	6.67	6.84	7.01	7.17	7.33	7.48	7.64	7.93	4⅝
4¾	5.66	5.86	6.06	6.26	6.44	6.62	6.80	6.97	7.14	7.31	7.47	7.62	7.78	8.08	4¾
4⅞	5.78	5.99	6.19	6.39	6.57	6.76	6.93	7.11	7.28	7.44	7.60	7.76	7.92	8.22	4⅞
5	5.91	6.12	6.32	6.52	6.70	6.89	7.07	7.24	7.41	7.58	7.74	7.90	8.06	8.36	5
5⅛	6.04	6.25	6.45	6.64	6.83	7.02	7.20	7.37	7.55	7.72	7.88	8.04	8.21	8.51	5⅛
5¼	6.17	6.37	6.58	6.77	6.96	7.15	7.33	7.51	7.68	7.85	8.02	8.18	8.34	8.65	5¼
5⅜	6.29	6.50	6.71	6.90	7.09	7.28	7.46	7.64	7.82	7.99	8.15	8.31	8.48	8.79	5¾

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 5½" dia. x ½" high to 8¼" dia. x 2¼" high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	
5½	6.42	6.63	6.83	7.03	7.22	7.41	7.60	7.77	7.95	8.12	8.29	8.45	8.61	8.93	5½
5⅝	6.54	6.76	6.96	7.16	7.35	7.54	7.73	7.91	8.08	8.25	8.42	8.59	8.75	9.07	5⅝
5¾	6.67	6.88	7.09	7.29	7.48	7.67	7.86	8.04	8.22	8.39	8.56	8.72	8.89	9.20	5¾
5⅞	6.80	7.01	7.22	7.42	7.61	7.80	7.99	8.17	8.35	8.52	8.69	8.86	9.02	9.34	5⅞
6	6.92	7.14	7.34	7.55	7.74	7.93	8.12	8.30	8.48	8.66	8.83	9.00	9.16	9.48	6
6¼	7.18	7.39	7.60	7.80	8.00	8.19	8.38	8.57	8.75	8.92	9.10	9.27	9.44	9.76	6¼
6½	7.43	7.64	7.85	8.06	8.26	8.45	8.64	8.83	9.01	9.19	9.36	9.54	9.71	10.03	6½
6¾	7.68	7.90	8.11	8.31	8.51	8.71	8.90	9.09	9.27	9.45	9.63	9.80	9.97	10.31	6¾
7	7.93	8.15	8.36	8.57	8.77	8.97	9.16	9.35	9.53	9.72	9.90	10.07	10.24	10.58	7
7¼	8.18	8.40	8.62	8.82	9.03	9.22	9.42	9.61	9.80	9.98	10.16	10.34	10.51	10.85	7¼
7½	8.44	8.66	8.87	9.08	9.28	9.48	9.68	9.87	10.06	10.24	10.42	10.60	10.78	11.12	7½
7¾	8.69	8.91	9.12	9.33	9.54	9.74	9.94	10.13	10.32	10.50	10.69	10.87	11.04	11.39	7¾
8	8.94	9.16	9.38	9.59	9.79	10.00	10.19	10.39	10.58	10.77	10.95	11.13	11.31	11.66	8
8¼	9.19	9.41	9.63	9.84	10.05	10.25	10.45	10.65	10.84	11.03	11.21	11.39	11.57	11.92	8¼

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 8½″ dia. x ½″ high to 12″ dia. x 2¼″ high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	
8½	9.44	9.66	9.88	10.10	10.30	10.51	10.71	10.90	11.10	11.29	11.47	11.66	11.84	12.19	8½
8¾	9.69	9.92	10.13	10.35	10.56	10.76	10.96	11.16	11.36	11.55	11.73	11.92	12.10	12.46	8¾
9	9.95	10.17	10.39	10.60	10.81	11.02	11.21	11.42	11.61	11.81	11.99	12.18	12.36	12.72	9
9¼	10.20	10.42	10.64	10.85	11.07	11.27	11.48	11.68	11.87	12.07	12.26	12.44	12.63	12.99	9¼
9½	10.45	10.67	10.89	11.11	11.32	11.53	11.73	11.93	12.13	12.32	12.52	12.70	12.89	13.25	9½
9¾	10.70	10.92	11.14	11.36	11.57	11.78	11.99	12.19	12.39	12.58	12.77	12.96	13.15	13.52	9¾
10	10.95	11.18	11.40	11.61	11.83	12.04	12.24	12.44	12.64	12.84	13.03	13.22	13.41	13.78	10
10¼	11.20	11.43	11.65	11.87	12.08	12.29	12.50	12.70	12.90	13.10	13.29	13.48	13.67	14.04	10¼
10½	11.45	11.68	11.90	12.12	12.33	12.54	12.75	12.96	13.16	13.36	13.55	13.74	13.93	14.30	10½
10¾	11.70	11.93	12.15	12.37	12.59	12.80	13.01	13.21	13.41	13.61	13.81	14.00	14.19	14.56	10¾
11	11.95	12.18	12.40	12.62	12.84	13.05	13.26	13.47	13.67	13.87	14.07	14.26	14.45	14.83	11
11¼	12.20	12.43	12.67	12.91	13.09	13.30	13.52	13.72	13.93	14.13	14.33	14.52	14.71	15.08	11¼
11½	12.45	12.65	12.90	13.11	13.35	13.56	13.77	13.98	14.18	14.38	14.58	14.78	14.97	15.35	11½
11¾	12.66	12.92	13.16	13.39	13.59	13.82	14.03	14.23	14.44	14.63	14.84	15.04	15.22	15.60	11¾
12	12.96	13.20	13.42	13.63	13.86	14.07	14.28	14.49	14.70	14.88	15.10	15.30	15.50	15.88	12

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From ¼″ dia. x 2½″ high to 1⅞″ dia. x 5¾″ high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	
¼	1.59	1.67	1.75	1.82	1.89	1.95	2.02	2.08	2.13	2.20	2.25	2.31	2.36	2.41	¼
⅜	1.98	2.07	2.16	2.24	2.32	2.40	2.48	2.55	2.63	2.70	2.76	2.83	2.90	2.96	⅜
½	2.29	2.39	2.50	2.60	2.69	2.78	2.88	2.96	3.04	3.12	3.20	3.28	3.35	3.42	½
⅝	2.58	2.69	2.80	2.92	3.02	3.12	3.23	3.32	3.42	3.50	3.59	3.68	3.76	3.84	⅝
¾	2.84	2.96	3.09	3.21	3.32	3.43	3.54	3.65	3.75	3.85	3.94	4.03	4.13	4.22	¾
⅞	3.08	3.22	3.38	3.50	3.63	3.75	3.84	3.95	4.06	4.17	4.27	4.38	4.47	4.57	⅞
1	3.31	3.46	3.61	3.74	3.87	4.00	4.13	4.24	4.35	4.46	4.58	4.69	4.79	4.89	1
1⅛	3.53	3.69	3.84	3.98	4.12	4.26	4.39	4.51	4.63	4.75	4.87	4.98	5.10	5.21	1⅛
1¼	3.75	3.91	4.07	4.22	4.37	4.51	4.65	4.78	4.90	5.03	5.15	5.27	5.39	5.50	1¼
1⅜	3.95	4.12	4.28	4.44	4.59	4.74	4.88	5.02	5.16	5.29	5.42	5.54	5.67	5.79	1⅜
1½	4.15	4.33	4.50	4.66	4.82	4.97	5.12	5.26	5.40	5.54	5.68	5.81	5.93	6.07	1½
1⅝	4.34	4.53	4.70	4.87	5.03	5.20	5.35	5.50	5.64	5.78	5.92	6.06	6.20	6.33	1⅝
1¾	4.54	4.73	4.90	5.08	5.25	5.42	5.57	5.72	5.88	6.02	6.17	6.31	6.45	6.58	1¾
1⅞	4.71	4.91	5.10	5.28	5.45	5.62	5.79	5.95	6.10	6.25	6.41	6.55	6.69	6.83	1⅞

*NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 2″ dia. x 2½″ high to 3⅝″ dia. x 5¾″ high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	
2	4.90	5.10	5.29	5.48	5.65	5.83	6.00	6.16	6.32	6.48	6.63	6.78	6.93	7.07	2
2⅛	5.08	5.28	5.48	5.67	5.85	6.03	6.21	6.38	6.54	6.70	6.86	7.01	7.16	7.31	2⅛
2¼	5.25	5.46	5.66	5.86	6.05	6.23	6.41	6.58	6.75	6.91	7.08	7.23	7.39	7.54	2¼
2⅜	5.42	5.64	5.84	6.04	6.24	6.42	6.61	6.78	6.96	7.13	7.29	7.45	7.61	7.76	2⅜
2½	5.59	5.81	6.02	6.22	6.42	6.61	6.80	6.98	7.16	7.33	7.50	7.66	7.82	7.98	2½
2⅝	5.76	5.98	6.20	6.40	6.61	6.80	6.99	7.18	7.36	7.53	7.71	7.88	8.04	8.20	2⅝
2¾	5.92	6.15	6.37	6.58	6.79	6.99	7.18	7.37	7.55	7.73	7.91	8.08	8.25	8.41	2¾
2⅞	6.08	6.32	6.54	6.76	6.96	7.17	7.37	7.56	7.75	7.93	8.11	8.29	8.46	8.62	2⅞
3	6.25	6.48	6.71	6.93	7.14	7.35	7.55	7.75	7.94	8.12	8.30	8.48	8.66	8.83	3
3⅛	6.40	6.64	6.87	7.10	7.32	7.52	7.73	7.93	8.12	8.31	8.50	8.68	8.86	9.03	3⅛
3¼	6.56	6.80	7.04	7.26	7.48	7.70	7.91	8.11	8.31	8.50	8.69	8.88	9.06	9.23	3¼
3⅜	6.72	6.96	7.20	7.43	7.66	7.87	8.08	8.29	8.49	8.69	8.88	9.07	9.25	9.43	3⅜
3½	6.87	7.12	7.37	7.60	7.83	8.05	8.26	8.47	8.68	8.87	9.06	9.26	9.45	9.63	3½
3⅝	7.03	7.28	7.52	7.76	7.99	8.21	8.43	8.65	8.85	9.06	9.25	9.45	9.64	9.82	3⅝

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 3¾″ dia. x 2½″ high to 5⅜″ dia. x 5¾″ high.

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	
3¾	7.18	7.43	7.68	7.92	8.16	8.38	8.60	8.82	9.03	9.23	9.44	9.63	9.82	10.01	3¾
3⅞	7.33	7.59	7.84	8.08	8.32	8.55	8.77	8.99	9.20	9.41	9.61	9.82	10.01	10.20	3⅞
4	7.48	7.74	8.00	8.24	8.48	8.71	8.94	9.16	9.38	9.59	9.79	10.00	10.20	10.39	4
4⅛	7.63	7.89	8.15	8.40	8.64	8.88	9.11	9.33	9.55	9.76	9.97	10.18	10.38	10.57	4⅛
4¼	7.78	8.05	8.31	8.56	8.80	9.04	9.27	9.50	9.72	9.94	10.15	10.35	10.56	10.76	4¼
4⅜	7.93	8.20	8.46	8.71	8.96	9.20	9.44	9.67	9.89	10.11	10.32	10.53	10.74	10.94	4⅜
4½	8.07	8.35	8.61	8.87	9.12	9.36	9.60	9.83	10.06	10.28	10.50	10.71	10.92	11.12	4½
4⅝	8.22	8.50	8.76	9.02	9.28	9.52	9.76	10.00	10.22	10.45	10.67	10.88	11.09	11.30	4⅝
4¾	8.37	8.64	8.91	9.18	9.43	9.68	9.92	10.16	10.39	10.62	10.84	11.05	11.27	11.47	4¾
4⅞	8.51	8.79	9.06	9.33	9.59	9.84	10.08	10.32	10.55	10.78	11.01	11.23	11.44	11.65	4⅞
5	8.66	8.94	9.21	9.48	9.74	10.00	10.24	10.48	10.72	10.95	11.18	11.40	11.61	11.83	5
5⅛	8.80	9.09	9.37	9.63	9.90	10.15	10.40	10.65	10.88	11.12	11.34	11.57	11.79	12.00	5⅛
5¼	8.94	9.23	9.51	9.78	10.05	10.31	10.56	10.80	11.04	11.28	11.51	11.74	11.96	12.17	5¼
5⅜	9.09	9.38	9.66	9.93	10.20	10.46	10.72	10.96	11.20	11.44	11.68	11.90	12.13	12.35	5⅜

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 5½" dia. x 2½" high to 8¼" dia. x 5¾" high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	
5½	9.23	9.52	9.81	10.08	10.35	10.62	10.87	11.12	11.36	11.60	11.84	12.07	12.29	12.52	5½
5⅝	9.37	9.67	9.95	10.23	10.50	10.77	11.02	11.28	11.52	11.76	12.00	12.23	12.46	12.69	5⅝
5¾	9.51	9.81	10.10	10.38	10.65	10.92	11.18	11.43	11.68	11.92	12.16	12.40	12.63	12.85	5¾
5⅞	9.65	9.95	10.24	10.52	10.80	11.07	11.33	11.59	11.84	12.08	12.32	12.56	12.79	13.02	5⅞
6	9.79	10.09	10.39	10.67	10.95	11.22	11.48	11.74	12.00	12.24	12.48	12.72	12.96	13.19	6
6¼	10.07	10.38	10.68	10.96	11.25	11.52	11.79	12.05	12.31	12.56	12.80	13.05	13.28	13.52	6¼
6½	10.35	10.66	10.96	11.25	11.54	11.82	12.09	12.36	12.62	12.87	13.12	13.37	13.61	13.85	6½
6¾	10.63	10.94	11.25	11.54	11.83	12.11	12.39	12.66	12.92	13.18	13.43	13.68	13.93	14.17	6¾
7	10.90	11.22	11.53	11.83	12.12	12.40	12.68	12.96	13.23	13.49	13.74	14.00	14.24	14.49	7
7¼	11.18	11.50	11.81	12.11	12.41	12.70	12.98	13.25	13.52	13.79	14.05	14.31	14.56	14.80	7¼
7½	11.45	11.77	12.09	12.39	12.69	12.99	13.27	13.55	13.82	14.09	14.36	14.62	14.87	15.12	7½
7¾	11.72	12.05	12.37	12.68	12.98	13.27	13.56	13.84	14.12	14.39	14.66	14.92	15.18	15.43	7¾
8	11.99	12.32	12.64	12.96	13.26	13.56	13.85	14.14	14.42	14.69	14.96	15.23	15.49	15.74	8
8¼	12.27	12.60	12.92	13.23	13.54	13.84	14.14	14.43	14.71	14.99	15.26	15.53	15.79	16.05	8¼

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page **59.**

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 8½″ dia. x 2½″ high to 12″ dia. x 5¾″ high

Diameter of Shell	HEIGHT OF SHELL														Diameter of Shell
	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	
8½	12.53	12.87	13.20	13.51	13.82	14.13	14.43	14.72	15.00	15.28	15.56	15.83	16.10	16.36	8½
8¾	12.80	13.14	13.47	13.79	14.10	14.41	14.71	15.00	15.29	15.58	15.86	16.13	16.40	16.66	8¾
9	13.07	13.41	13.74	14.07	14.38	14.69	14.99	15.29	15.58	15.87	16.15	16.43	16.70	16.97	9
9¼	13.34	13.68	14.02	14.34	14.66	14.97	15.28	15.58	15.87	16.16	16.44	16.72	17.00	17.26	9¼
9½	13.61	13.95	14.29	14.61	14.94	15.25	15.56	15.86	16.16	16.45	16.74	17.02	17.29	17.57	9½
9¾	13.87	14.22	14.56	14.89	15.21	15.53	15.84	16.14	16.44	16.74	17.03	17.31	17.59	17.86	9¾
10	14.14	14.49	14.83	15.16	15.49	15.81	16.12	16.43	16.73	17.02	17.31	17.60	17.88	18.15	10
10¼	14.40	14.75	15.10	15.43	15.76	16.08	16.40	16.71	17.01	17.31	17.60	17.89	18.18	18.46	10¼
10½	14.66	15.02	15.36	15.70	16.03	16.36	16.68	16.99	17.29	17.59	17.89	18.18	18.47	18.75	10½
10¾	14.93	15.29	15.63	15.97	16.31	16.63	16.95	17.27	17.58	17.88	18.18	18.47	18.76	19.04	10¾
11	15.19	15.55	15.90	16.24	16.58	16.91	17.23	17.55	17.86	18.16	18.46	18.76	19.05	19.33	11
11¼	15.46	15.82	16.17	16.52	16.84	17.17	17.50	17.81	18.12	18.44	18.74	19.03	19.33	19.62	11¼
11½	15.72	16.08	16.43	16.78	17.11	17.45	17.78	18.09	18.41	18.71	19.02	19.32	19.63	19.92	11½
11¾	15.98	16.34	16.70	17.05	17.39	17.73	18.05	18.38	18.70	19.01	19.32	19.61	19.90	20.21	11¾
12	16.24	16.61	16.96	17.32	17.66	18.00	18.33	18.64	18.97	19.28	19.59	19.89	20.20	20.49	12

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From ¼″ dia. x 6″ high to 1⅞″ dia. x 12″ high

Diameter of Shell	HEIGHT OF SHELL													Diameter of Shell
	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	
¼	2.46	2.56	2.66	2.75	2.83	2.93	3.01	3.09	3.17	3.25	3.33	3.40	3.48	¼
⅜	3.03	3.15	3.27	3.38	3.48	3.59	3.70	3.80	3.90	3.98	4.08	4.17	4.26	⅜
½	3.50	3.64	3.77	3.90	4.03	4.15	4.27	4.39	4.50	4.61	4.71	4.82	4.93	½
⅝	3.92	4.08	4.23	4.38	4.52	4.65	4.78	4.91	5.04	5.16	5.28	5.39	5.51	⅝
¾	4.30	4.48	4.64	4.80	4.96	5.10	5.25	5.39	5.53	5.66	5.79	5.92	6.05	¾
⅞	4.66	4.84	5.03	5.19	5.36	5.52	5.68	5.83	5.98	6.12	6.26	6.40	6.53	⅞
1	5.00	5.19	5.39	5.57	5.74	5.92	6.08	6.24	6.40	6.56	6.71	6.86	7.00	1
1⅛	5.31	5.52	5.72	5.92	6.10	6.28	6.46	6.63	6.80	6.96	7.12	7.28	7.43	1⅛
1¼	5.61	5.84	6.04	6.25	6.45	6.64	6.82	7.00	7.18	7.35	7.52	7.68	7.84	1¼
1⅜	5.90	6.13	6.35	6.57	6.78	6.97	7.16	7.35	7.54	7.73	7.89	8.07	8.24	1⅜
1½	6.19	6.42	6.65	6.87	7.09	7.30	7.50	7.70	7.89	8.08	8.26	8.44	8.62	1½
1⅝	6.45	6.70	6.94	7.17	7.39	7.61	7.82	8.02	8.22	8.42	8.61	8.80	8.98	1⅝
1¾	6.71	6.97	7.22	7.46	7.69	7.91	8.13	8.34	8.55	8.75	8.95	9.14	9.33	1¾
1⅞	6.96	7.23	7.49	7.73	7.97	8.20	8.43	8.64	8.86	9.07	9.27	9.48	9.67	1⅞

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 2″ dia. x 6″ high to 3⅝″ dia. x 12″ high

Diameter of Shell	HEIGHT OF SHELL													Diameter of Shell
	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	
2	7.21	7.49	7.75	8.00	8.25	8.48	8.72	8.94	9.17	9.38	9.59	9.80	10.00	2
2⅛	7.45	7.73	8.00	8.26	8.52	8.76	9.00	9.23	9.46	9.68	9.90	10.11	10.32	2⅛
2¼	7.68	7.97	8.25	8.52	8.78	9.03	9.28	9.52	9.75	9.98	10.21	10.42	10.63	2¼
2⅜	7.91	8.21	8.49	8.77	9.03	9.29	9.55	9.79	10.03	10.26	10.49	10.72	10.94	2⅜
2½	8.14	8.44	8.73	9.01	9.29	9.55	9.81	10.06	10.31	10.55	10.78	11.01	11.24	2½
2⅝	8.36	8.67	8.97	9.25	9.53	9.80	10.07	10.33	10.58	10.82	11.06	11.30	11.53	2⅝
2¾	8.58	8.89	9.20	9.49	9.78	10.05	10.32	10.59	10.84	11.09	11.33	11.58	11.81	2¾
2⅞	8.79	9.11	9.42	9.72	10.01	10.29	10.57	10.84	11.11	11.35	11.61	11.85	12.09	2⅞
3	9.00	9.33	9.64	9.95	10.25	10.53	10.82	11.09	11.36	11.62	11.87	12.12	12.37	3
3⅛	9.20	9.54	9.86	10.17	10.48	10.77	11.06	11.34	11.61	11.88	12.13	12.39	12.64	3⅛
3¼	9.41	9.75	10.08	10.40	10.70	11.00	11.29	11.58	11.86	12.13	12.39	12.65	12.90	3¼
3⅜	9.61	9.96	10.29	10.61	10.93	11.23	11.53	11.82	12.10	12.37	12.64	12.91	13.17	3⅜
3½	9.81	10.16	10.50	10.83	11.15	11.46	11.76	12.05	12.34	12.62	12.89	13.16	13.43	3½
3⅝	10.00	10.36	10.71	11.04	11.36	11.68	11.98	12.28	12.57	12.86	13.14	13.41	13.68	3⅝

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 3¾″ dia. x 6″ high to 5⅜″ dia. x 12″ high

Diameter of Shell	HEIGHT OF SHELL													Diameter of Shell
	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	
3¾	10.20	10.56	10.91	11.25	11.58	11.90	12.21	12.51	12.80	13.09	13.37	13.65	13.93	3¾
3⅞	10.39	10.76	11.11	11.45	11.79	12.11	12.43	12.74	13.04	13.33	13.62	13.90	14.18	3⅞
4	10.58	10.95	11.31	11.66	12.00	12.33	12.65	12.96	13.26	13.56	13.85	14.14	14.42	4
4⅛	10.76	11.14	11.51	11.86	12.20	12.54	12.86	13.18	13.49	13.79	14.09	14.38	14.66	4⅛
4¼	10.95	11.33	11.71	12.06	12.41	12.75	13.07	13.40	13.72	14.02	14.32	14.61	14.90	4¼
4⅜	11.14	11.52	11.90	12.26	12.61	12.95	13.29	13.61	13.93	14.24	14.54	14.84	15.13	4⅜
4½	11.32	11.71	12.09	12.45	12.81	13.16	13.50	13.82	14.15	14.45	14.77	15.07	15.37	4½
4⅝	11.50	11.90	12.28	12.65	13.01	13.36	13.70	14.04	14.36	14.68	14.99	15.30	15.60	4⅝
4¾	11.68	12.08	12.47	12.84	13.21	13.56	13.91	14.25	14.57	14.90	15.22	15.52	15.83	4¾
4⅞	11.86	12.26	12.65	13.03	13.41	13.76	14.11	14.45	14.79	15.11	15.43	15.74	16.05	4⅞
5	12.04	12.45	12.84	13.23	13.60	13.96	14.32	14.66	15.00	15.33	15.65	15.97	16.28	5
5⅛	12.21	12.63	13.03	13.41	13.79	14.16	14.52	14.86	15.21	15.54	15.87	16.19	16.50	5⅛
5¼	12.39	12.81	13.21	13.60	13.98	14.35	14.71	15.07	15.41	15.75	16.08	16.40	16.72	5¼
5⅜	12.56	12.98	13.39	13.79	14.17	14.54	14.91	15.27	15.61	15.95	16.29	16.61	16.93	5⅜

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 5½″ dia. x 6″ high to 8¼″ dia. x 12″ high

Diameter of Shell	HEIGHT OF SHELL													Diameter of Shell
	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	
5½	12.73	13.16	13.57	13.97	14.36	14.73	15.11	15.47	15.82	16.16	16.50	16.83	17.15	5½
5⅝	12.90	13.33	13.75	14.15	14.54	14.93	15.30	15.66	16.02	16.36	16.70	17.04	17.36	5⅝
5¾	13.07	13.51	13.93	14.33	14.73	15.11	15.49	15.86	16.21	16.57	16.91	17.25	17.58	5¾
5⅞	13.24	13.68	14.10	14.51	14.91	15.30	15.68	16.05	16.42	16.77	17.11	17.45	17.79	5⅞
6	13.41	13.85	14.28	14.69	15.10	15.49	15.87	16.24	16.61	16.97	17.32	17.66	18.00	6
6¼	13.74	14.19	14.63	15.05	15.46	15.86	16.25	16.63	17.00	17.36	17.72	18.07	18.41	6¼
6½	14.08	14.53	14.97	15.40	15.82	16.22	16.62	17.00	17.38	17.75	18.11	18.47	18.82	6½
6¾	14.40	14.86	15.31	15.75	16.17	16.58	16.98	17.38	17.76	18.14	18.50	18.87	19.22	6¾
7	14.73	15.19	15.65	16.09	16.52	16.94	17.34	17.74	18.13	18.52	18.89	19.26	19.62	7
7¼	15.05	15.52	15.98	16.43	16.86	17.29	17.70	18.11	18.51	18.89	19.27	19.64	20.01	7¼
7½	15.37	15.85	16.31	16.77	17.21	17.64	18.06	18.47	18.87	19.26	19.65	20.03	20.40	7½
7¾	15.68	16.17	16.64	17.10	17.55	17.98	18.41	18.82	19.23	19.63	20.02	20.40	20.78	7¾
8	15.99	16.49	16.97	17.43	17.88	18.33	18.76	19.18	19.59	19.99	20.39	20.78	21.16	8
8¼	16.31	16.80	17.29	17.76	18.22	18.66	19.10	19.53	19.95	20.36	20.76	21.15	21.54	8¼

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

* APPROXIMATE DIAMETER OF BLANKS FOR SHELLS

From 8½″ dia. x 6″ high to 12″ dia. x 12″ high

Diameter of Shell	HEIGHT OF SHELL													Diameter of Shell
	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	
8½	16.62	17.12	17.61	18.09	18.55	19.00	19.44	19.88	20.30	20.71	21.11	21.51	21.91	8½
8¾	16.92	17.43	17.93	18.41	18.88	19.34	19.78	20.22	20.65	21.07	21.48	21.88	22.28	8¾
9	17.23	17.74	18.24	18.73	19.20	19.67	20.12	20.56	21.00	21.42	21.84	22.24	22.64	9
9¼	17.53	18.05	18.56	19.05	19.53	20.00	20.45	20.90	21.34	21.77	22.19	22.60	23.00	9¼
9½	17.83	18.36	18.87	19.37	19.85	20.32	20.79	21.24	21.68	22.11	22.54	22.96	23.37	9½
9¾	18.14	18.66	19.18	19.68	20.17	20.65	21.12	21.57	22.02	22.46	22.89	23.31	23.72	9¾
10	18.43	18.97	19.49	20.00	20.49	20.97	21.44	21.90	22.36	22.80	23.24	23.66	24.08	10
10¼	18.73	19.27	19.80	20.31	20.81	21.29	21.77	22.23	22.69	23.14	23.58	24.01	24.43	10¼
10½	19.03	19.57	20.10	20.62	21.12	21.61	22.09	22.56	23.02	23.47	23.92	24.35	24.78	10½
10¾	19.32	19.87	20.40	20.93	21.43	21.93	22.41	22.89	23.35	23.81	24.25	24.69	25.13	10¾
11	19.62	20.17	20.71	21.23	21.74	22.24	22.73	23.21	23.68	24.14	24.59	25.04	25.47	11
11¼	19.90	20.46	21.01	21.54	22.05	22.55	23.06	23.54	24.00	24.47	24.92	25.37	25.82	11¼
11½	20.20	20.76	21.30	21.84	22.36	22.87	23.36	23.85	24.33	24.80	25.25	25.70	26.15	11½
11¾	20.50	21.05	21.61	22.14	22.67	23.18	23.68	24.17	24.66	25.13	25.58	26.04	26.49	11¾
12	20.77	21.35	21.90	22.45	22.97	23.50	23.99	24.48	24.97	25.45	25.93	26.37	26.84	12

* NOTE—When using this table the notes on page 60 should be referred to. For rule, see page 59.

THEORETICAL WEIGHT OF SHEET STEEL BLANKS

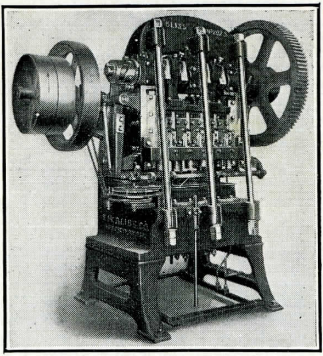
Diameter	⅛	3⁄16	¼	5⁄16	⅜	7⁄16	½
16...	7	11	15	18	22	25	29
17...	8	12	16	20	24	28	32
18...	9	14	18	23	27	32	36
19...	10	15	20	25	30	35	40
20...	11	17	23	28	34	39	45
21...	12	19	25	31	37	43	49
22...	14	20	27	34	41	47	54
23...	15	22	30	37	44	52	59
24...	16	24	32	40	48	56	64
25...	18	26	35	44	53	61	70
26...	19	28	38	47	56	66	75
27...	20	30	41	51	61	71	81
28...	22	33	44	55	65	76	87
29...	24	35	47	59	71	82	94
30...	25	38	50	63	75	88	100
31...	27	40	54	67	80	94	107
32...	29	43	57	71	86	100	114
33...	30	45	61	76	91	106	121
34...	32	48	65	81	97	113	129
35...	34	51	68	85	102	119	136
36...	36	54	72	90	108	126	144
37...	38	57	76	95	115	134	153
38...	40	60	80	100	121	141	161
39...	42	64	85	106	127	148	169
40...	45	67	89	111	134	156	178
41...	47	70	94	117	141	164	187
42...	49	74	98	123	148	172	197
43...	52	77	103	129	155	180	206
44...	54	81	108	135	162	188	215
45..	56	85	113	141	169	197	225
46...	59	88	118	147	177	206	235
47...	62	92	123	154	185	215	246
48...	64	96	128	160	193	225	257
49...	67	100	134	167	201	234	267
50...	70	105	139	174	209	244	279
51...	...	109	145	181	217	253	289
52...	...	113	151	188	226	263	301
53...	...	117	156	195	235	273	313
54...	...	122	162	203	244	284	325
55...	...	126	168	210	253	295	337

From Joseph T. Ryerson & Son

THEORETICAL WEIGHT OF SHEET STEEL BLANKS

Diameter	9/16	5/8	11/16	3/4	13/16	7/8
36...	162	180	198	216	234	252
37...	172	191	210	229	248	267
38...	181	201	221	241	261	281
39...	190	212	233	254	275	296
40...	200	223	245	267	289	312
41...	211	234	258	281	304	327
42...	221	246	270	295	319	344
43...	232	258	283	309	335	360
44...	242	269	296	323	350	377
45...	253	282	310	338	366	394
46...	265	294	324	353	383	412
47	277	308	338	369	399	430
48...	289	321	353	385	417	449
49...	301	334	367	401	434	467
50...	313	348	383	418	452	487
51...	325	362	398	434	470	506
52...	339	376	414	452	489	527
53...	352	391	430	469	508	547
54...	365	406	446	487	527	568
55...	379	421	463	505	547	589
56...	393	436	480	524	567	610
57...	407	453	498	543	587	633
58...	421	468	515	562	609	655
59...	436	484	533	581	629	678
60...	451	501	551	601	651	701
61...	466	518	569	621	673	724
62...	482	535	589	642	695	749
63...	497	553	608	663	718	774
64...	513	570	627	684	741	798
65...	529	588	647	706	764	823
66...	546	607	667	728	788	848
67...	563	625	688	750	812	874
68...	579	643	708	772	836	900
69...	596	663	729	795	861	927
70...	613	682	750	818	886	954
71...	631	702	772	842	912	982
72...	649	722	794	866	937	1009
73...	667	742	816	890	964	1038
74...	686	763	839	915	990	1066
75...	704	783	861	939	1017	1095

From Joseph T. Ryerson & Son



"BLISS" AUTOMATIC PRESS—For the rapid and economical production of articles which require a series of operations to be performed, such as harness, oil can tops, burner parts, salt cellars, door knobs, etc. Built with 4 or 5 Punch Slides. Weight, as shown, 8,500 lbs.

SPECIFIC GRAVITY IRON AND STEEL

	Iron	Steel
Specific gravity..................	7.7	7.854
Weight per cubic foot........	480.	489.6
Weight per cubic inch.......	.2778	.2833

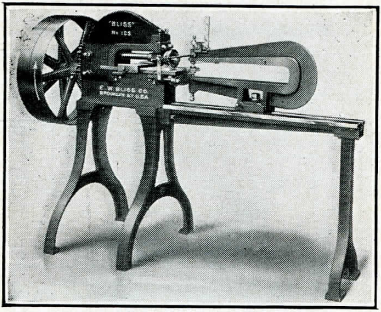
As there are many guages in use differing from each other, and even the thicknesses of a certain specified guage, as the Birmingham, are not assumed the same by all manufacturers, orders for sheets and wires should always state the weight per square foot or the thickness in thousandths of an inch.

To Compute the Weight of Sheet Steel—Divide the thickness, expressed in thousandths, by 25. the result is the weight, in pounds, per square foot.

WEIGHT OF IRON AND STEEL SHEETS

Weight Per Square Foot.—*Kent.*

Thickness by Birmingham Gauge				Thickness by American (Brown & Sharpe's) Gauge			
No. of Gauge	Thickness in Inches	Iron, Lbs.	Steel, Lbs.	No. of Gauge	Thickness in Inches	Iron, Lbs.	Steel, Lbs.
1	.3	12.00	12.24	1	.2893	11.57	11.80
2	.284	11.36	11.59	2	.2576	10.30	10.51
3	.259	10.36	10.57	3	.2294	9.18	9.36
4	.238	9.52	9.71	4	.2043	8.17	8.34
5	.22	8.80	8.98	5	.1819	7.28	7.42
6	.203	8.12	8.28	6	.1620	6.48	6.61
7	.18	7.20	7.34	7	.1443	5.77	5.89
8	.165	6.60	6.73	8	.1285	5.14	5.24
9	.148	5.92	6.04	9	.1144	4.58	4.67
10	.134	5.36	5.47	10	.1019	4.08	4.16
11	.12	4.80	4.90	11	.0907	3.63	3.70
12	.109	4.36	4.45	12	.0808	3.23	3.30
13	.095	3.80	3.88	13	.0720	2.88	2.94
14	.083	3.32	3.39	14	.0641	2.56	2.62
15	.072	2.88	2.94	15	.0571	2.28	2.33
16	.065	2.60	2.65	16	.0508	2.03	2.07
17	.058	2.32	2.37	17	.0453	1.81	1.85
18	.049	1.96	2.00	18	.0403	1.61	1.64
19	.042	1.68	1.71	19	.0359	1.44	1.46
20	.035	1.40	1.43	20	.0320	1.28	1.31
21	.032	1.28	1.31	21	.0285	1.14	1.16
22	.028	1.12	1.14	22	.0253	1.01	1.03
23	.025	1.00	1.02	23	.0226	.904	.922
24	.022	.88	.898	24	.0201	.804	.820
25	.02	.80	.816	25	.0179	.716	.730
26	.018	.72	.734	26	.0159	.636	.649
27	.016	.64	.653	27	.0142	.568	.579
28	.014	.56	.571	28	.0126	.504	.514
29	.013	.52	.530	29	.0113	.452	.461
30	.012	.48	.490	30	.0100	.400	.408
31	.01	.40	.408	31	.0089	.356	.363
32	.009	.36	.367	32	.0080	.320	.326
33	.008	.32	.326	33	.0071	.284	.290
34	.007	.28	.286	34	.0063	.252	.257
35	.005	.20	.204	35	.0056	.224	.228



"BLISS" CIRCLE CUTTING AND SLITTING SHEARS.—Built in a large number of sizes. The machine illustrated will cut circles 7″ to 30″ in diameter of No. 16 U. S. Std. Gauge soft steel. Weight 850 lbs. We build shears adapted for making both inside and outside cuts on armature disks and other rings.

WEIGHT OF ALUMINUM SHEETS, SQUARE AND ROUND BARS

Thickness or Diameter Inches	Sheets per Square Foot Pounds	Round Bars Per Foot Pounds	Square Bars Per Foot Pounds
1/16	0.876	0.004	0.005
1/8	1.751	.014	.018
1/4	3.503	.057	.073
3/8	5.254	.129	.164
1/2	7.006	.229	.292
5/8	8.757	.358	.456
3/4	10.508	.516	.657
7/8	12.260	.702	.894
1	14.011	.917	1.168
1 1/4	17.514	1.433	1.824
1 1/2	21.017	2.063	2.627
2	28.022	3.668	4.671

(Specific Gravity 2.68; 1 cub. in. = 0.0973 lb.)

Kent

STANDARD PIPE AND PIPE THREADS

A = outside diameter of perfect thread.
B = inside diameter of pipe.
C = root diameter of thread at end of pipe.
D = length of perfect thread.

Size	Thread	A	B	C	D
⅛	27	.405	.270	.334	.19
¼	18	.540	.364	.433	.29
⅜	18	.675	.494	.567	.30
½	14	.840	.623	.702	.39
¾	14	1.050	.824	.911	.40
1	11½	1.315	1.048	1.144	.51
1¼	11½	1.660	1.380	1.488	.54
1½	11½	1.900	1.611	1.727	.55
2	11½	2.375	2.067	2.200	.58
2½	8	2.875	2.468	2.618	.89
3	8	3.500	3.067	3.243	.95
3½	8	4.000	3.548	3.738	1.00
4	8	4.500	4.026	4.233	1.05
4½	8	5.000	4.508	4.733	1.10
5	8	5.663	5.045	5.289	1.16
6	8	6.625	6.065	6.347	1.26
7	8	7.625	7.023	7.340	1.36
8	8	8.625	7.981	8.332	1.46
9	8	9.625	8.937	9.324	1.56
10	8	10.750	10.019	10.445	1.675
11	8	12.000	11.224	11.694	1.80
12	8	13.000	12.180	12.685	1.90

WEIGHTS

Of Square and Round Bars of Wrought Iron

In Pounds Per Lineal Foot.—*Kent*

Iron weighing 480 lbs. per cubic foot. For steel add 2 per cent.

Thickness or Diameter in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diameter in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
0			2	13.33	10.47
1/16	.013	.010	1/16	14.18	11.14
1/8	.052	.041	1/8	15.05	11.82
3/16	.117	.092	3/16	15.95	12.53
1/4	.208	.164	1/4	16.88	13.25
5/16	.326	.256	5/16	17.83	14.00
3/8	.469	.368	3/8	18.80	14.77
7/16	.638	.501	7/16	19.80	15.55
1/2	.833	.654	1/2	20.83	16.36
9/16	1.055	.828	9/16	21.89	17.19
5/8	1.302	1.023	5/8	22.97	18.04
11/16	1.576	1.237	11/16	24.08	18.91
3/4	1.875	1.473	3/4	25.21	19.80
13/16	2.201	1.728	13/16	26.37	20.71
7/8	2.552	2.004	7/8	27.55	21.64
15/16	2.930	2.301	15/16	28.76	22.59
1	3.333	2.618	3	30.00	23.56
1/16	3.763	2.955	1/16	31.26	24.55
1/8	4.219	3.313	1/8	32.55	25.57
3/16	4.701	3.692	3/16	33.87	26.60
1/4	5.208	4.091	1/4	35.21	27.65
5/16	5.742	4.510	5/16	36.58	28.73
3/8	6.302	4.950	3/8	37.97	29.82
7/16	6.888	5.410	7/16	39.39	30.94
1/2	7.500	5.890	1/2	40.83	32.07
9/16	8.138	6.392	9/16	42.30	33.23
5/8	8.802	6.913	5/8	43.80	34.40
11/16	9.942	7.455	11/16	45.33	35.60
3/4	10.21	8.018	3/4	46.88	36.82
13/16	10.95	8.601	13/16	48.45	38.05
7/8	11.72	9.204	7/8	50.05	39.31
15/16	12.51	9.828	15/16	51.68	40.59

WEIGHTS

Of Square and Round Bars of Wrought Iron

In Pounds Per Lineal Foot.—*Kent*

Iron weighing 480 lbs. per cubic foot. For steel add 2 per cent.

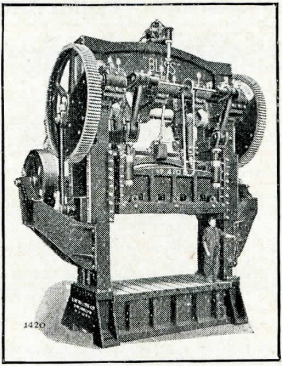
Thickness or Diameter in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long	Thickness or Diameter in Inches	Weight of Square Bar One Foot Long	Weight of Round Bar One Foot Long
4	53.33	41.89	6	120.0	94.25
1⁄16	55.01	43.21	⅛	125.1	98.22
⅛	56.72	44.55	¼	130.2	102.3
3⁄16	58.45	45.91	⅜	135.5	106.4
¼	60.21	47.29	½	140.8	110.6
5⁄16	61.99	48.69	⅝	146.3	114.9
⅜	63.80	50.11	¾	151.9	119.3
7⁄16	65.64	51.55	⅞	157.6	123.7
½	67.50	53.01	7	163.3	128.3
9⁄16	69.39	54.50	⅛	169.2	132.9
⅝	71.30	56.00	¼	175.2	137.6
11⁄16	73.24	57.52	⅜	181.3	142.4
¾	75.21	59.07	½	187.5	147.3
13⁄16	77.20	60.63	⅝	193.8	152.2
⅞	79.22	62.22	¾	200.2	157.2
15⁄16	81.26	63.82	⅞	206.7	162.4
5	83.33	65.45	8	213.3	167.6
1⁄16	85.43	67.10	¼	226.9	178.2
⅛	87.55	68.76	½	240.8	189.2
3⁄16	89.70	70.45	¾	255.2	200.4
¼	91.88	72.16	9	270.0	212.1
5⁄16	94.08	73.89	¼	285.2	224.0
⅜	96.30	75.64	½	300.8	236.3
7⁄16	98.55	77.40	¾	316.9	248.9
½	100.8	79.19	10	333.3	261.8
9⁄16	103.1	81.00	¼	350.2	275.1
⅝	105.5	82.83	½	367.5	288.6
11⁄16	107.8	84.69	¾	385.2	302.5
¾	110.2	86.56	11	403.3	316.8
13⁄16	112.6	88.45	¼	421.9	331.3
⅞	115.1	90.36	½	440.8	346.2
15⁄16	117.5	92.29	¾	460.2	361.4
			12	480.0	377.0

APPROXIMATE WEIGHTS OF STEEL HEXAGON BARS

Pounds per Lineal Foot

Size	Weight	Size	Weight
1/8	.046	1 3/16	4.152
5/32	.072	1 1/4	4.601
3/16	.103	1 5/16	5.072
7/32	.141	1 3/8	5.567
1/4	.184	1 7/16	6.085
9/32	.233	1 1/2	6.625
5/16	.287	1 9/16	7.189
11/32	.348	1 5/8	7.775
3/8	.414	1 11/16	8.385
13/32	.486	1 3/4	9.018
7/16	.564	1 13/16	9.673
15/32	.647	1 7/8	10.352
1/2	.736	1 15/16	11.053
17/32	.831	2	11.778
9/16	.932	2 1/8	13.296
19/32	1.038	2 1/4	14.907
5/8	1.150	2 3/8	16.609
21/32	1.268	2 1/2	18.403
11/16	1.392	2 5/8	20.289
23/32	1.521	2 3/4	22.268
3/4	1.656	2 7/8	24.338
25/32	1.797	3	26.500
13/16	1.944	3 1/8	28.755
27/32	2.096	3 1/4	31.101
7/8	2.254	3 3/8	33.540
29/32	2.418	3 1/2	36.070
15/16	2.588	3 5/8	38.692
31/32	2.763	3 3/4	41.407
1	2.944	3 7/8	44.213
1 1/16	3.324	4	47.112
1 1/8	3.727		

From Joseph T. Ryerson & Sons



"BLISS" DOUBLE-CRANK TOGGLE DRAWING PRESSES.—Built in 40 sizes, adapted for heavy drawing and stamping of large articles, such as automobile radiators, mud guards, trays, stove tops, seamless roasters, and a similar class of work. Weights 15,000 to 325,000 lbs.

WEIGHT, ONE SQUARE FOOT OF METALS

Thickness	Wrought Iron	Cast Iron	Steel	Copper	Brass	Lead
in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1/16	2.50	2.34	2.55	2.89	2.63	3.71
1/8	5.00	4.69	5.10	5.79	5.26	7.41
3/16	7.50	7.03	7.65	8.68	7.89	11.1
1/4	10.0	9.38	10.2	11.6	10.5	14.8
5/16	12.5	11.7	12.8	14.5	13.2	18.5
3/8	15.0	14.1	15.3	17.4	15.8	22.2
7/16	17.5	16.4	17.9	20.3	18.4	25.9
1/2	20.0	18.7	20.4	23.2	21.1	29.7

Weight of BRASS, COPPER and TOBIN BRONZE RODS—Pounds Per Linear Foot

Dia	Brass			Copper			Tobin Bronze			Dia.
Inch	Round	Square	Hexagon	Round	Square	Hexagon	Round	Square	Hexagon	Inch
1/16	01132	01441	.01248	.01184	.01507	01305	.01118	.01423	.01233	1/16
1/8	04527	.05764	.04992	04735	.06029	.05221	.04471	05693	.04930	1/8
3/16	1019	.1297	.1123	1065	.1356	.1175	.1006	.1281	.1109	3/16
1/4	1811	.2306	.1997	.1894	.2412	.2088	.1788	.2277	.1972	1/4
5/16	2829	.3602	.3120	.2959	.3768	.3263	.2794	.3558	.3081	5/16
3/8	.4074	.5188	.4493	.4261	.5426	.4699	.4024	.5124	.4437	3/8
7/16	5546	.7061	.6115	.5800	.7386	.6396	.5477	.6974	.6039	7/16
1/2	7243	.9222	.7987	.7576	.9646	.8354	.7154	.9108	.7888	1/2
9/16	.9167	1 167	1.011	.9588	1.221	1 057	.9054	1.153	.9983	9/16
5/8	1.132	1 441	1.248	1.184	1.507	1.305	1.118	1.423	1.232	5/8
11/16	1.369	1.744	1.510	1.432	1.824	1.579	1.353	1.722	1.491	11/16
3/4	1 630	2.075	1.797	1.705	2.170	1.880	1.610	2.049	1.775	3/4
13/16	1.913	2 435	2.109	2.001	2.547	2.206	1.889	2.405	2.083	13/16
7/8	2.218	2.824	2.446	2.320	2.954	2.558	2.191	2.789	2.416	7/8
15/16	2.546	3.242	2 808	2.663	3.391	2.937	2.515	3.202	2.773	15/16
1	2 897	3.689	3.195	3.030	3.858	3.341	2.862	3 643	3.155	1
1 1/16	3 271	4.164	3.607	3.421	4.356	3.772	3.230	4.113	3.562	1 1/16
1 1/8	3.667	4.669	4 043	3.835	4.883	4.229	3.622	4.611	3.993	1 1/8
1 3/16	4.086	5.202	4.505	4.273	5.441	4.712	4.035	5.138	4.449	1 3/16
1 1/4	4.527	5.764	4.992	4.735	6.029	5.221	4.471	5.693	4.930	1 1/4
1 5/16	4.991	6.355	5.503	5.220	6.647	5.756	4.929	6.276	5.435	1 5/16
1 3/8	5.478	6.974	6.040	5.729	7.295	6.317	5.410	6.888	5.965	1 3/8
1 7/16	5.987	7.623	6.602	6.262	7.973	6.905	5.913	7.529	6.520	1 7/16
1 1/2	6.519	8.300	7.188	6.818	8 681	7.518	6.438	8.198	7.099	1 1/2
1 9/16	7.073	9.006	7.800	7.398	9.420	8.158	6.986	8.895	7.703	1 9/16
1 5/8	7.651	9.741	8.436	8.002	10.19	8.824	7.556	9.621	8.332	1 5/8

Variations from these weights must be expected in practice.

From The American Brass Co.

Weight of BRASS, COPPER and TOBIN BRONZE RODS, Lbs. per Lin. Foot.—*(Cont.)*

Dia.	Brass			Copper			Tobin Bronze			Dia.
Inch	Round	Square	Hexagon	Round	Square	Hexagon	Round	Square	Hexagon	Inch
1 11/16	8.250	10.50	9.097	8.630	10.99	9.515	8.149	10.38	8.985	1 11/16
1¾	8.873	11.30	9.784	9.281	11.82	10.23	8.763	11.16	9.663	1¾
1 13/16	9.518	12.12	10.50	9.955	12.68	10.98	9.401	11.97	10.37	1 13/16
1⅞	10.19	12.97	11.23	10.65	13.56	11.75	10.06	12.81	11.09	1⅞
1 15/16	10.88	13.85	11.99	11.38	14.48	12.54	10.74	13.68	11.84	1 15/16
2	11.59	14.76	12.78	12.12	15.43	13.37	11.45	14.57	12.62	2
2⅛	13.08	16.66	14.43	13.68	17.42	15.09	12.92	16.45	14.25	2⅛
2¼	14.67	18.68	16.17	15.34	19.53	16.92	14.49	18.44	15.97	2¼
2⅜	16.34	20.81	18.02	17.09	21.76	18.85	16.14	20.55	17.80	2⅜
2½	18.11	23.06	19.97	18.94	24.12	20.88	17.88	22.77	19.72	2½
2⅝	19.96	25.42	22.01	20.88	26.59	23.02	19.72	25.11	21.74	2⅝
2¾	21.91	27.90	24.16	22.92	29.18	25.27	21.64	27.55	23.86	2¾
2⅞	23.95	30.49	26.41	25.05	31.89	27.62	23.65	30.12	26.08	2⅞
3	26.08	33.20	28.75	27.27	34.73	30.07	25.75	32.79	28.40	3
3¼				32.01	40.75	35.29	30.22	38.48	33.33	3¼
3½				37.12	47.27	40.93	35.05	44.63	38.65	3½
3¾				42.61	54.26	46.99	40.24	51.24	44.37	3¾
4				48.49	61.73	53.46	45.78	58.29	50.48	4
4¼				54.74	69.69	60.36	51.69	65.81	56.99	4¼
4½				61.37	78.13	67.67	57.75	73.78	63.89	4½
4¾				68.37	87.06	75.39	64.56	82.20	71.17	4¾
5.				75.76	96.46	83.54	71.54	91.08	78.88	5
5¼				83.53	106.3	92.10	78.87	100.4	86.97	5¼
5½				91.67	116.7	101.1	86.56	110.2	95.45	5½
5¾				100.2	127.6	110.5	94.61	120.5	104.3	5¾
6				109.1	138.9	120.3	103.0	131.2	113.6	6

Variations from these weights must be expected in practice.

From The American Brass Co.

WEIGHT OF FLAT ROLLED STEEL—POUNDS PER LINEAL FOOT

Thick-ness Inches	WIDTH—INCHES											
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	2
3/16	.319	.398	.478	.558	.638	.717	.797	.877	.956	1.04	1.12	1.28
1/4	.425	.531	.637	.744	.850	.956	1.06	1.17	1.28	1.38	1.49	1.70
5/16	.531	.664	.797	.930	1.06	1.20	1.33	1.46	1.59	1.73	1.86	2.13
3/8	.638	.797	.956	1.116	1.28	1.43	1.59	1.75	1.91	2.07	2.23	2.55
7/16	.744	.930	1.116	1.302	1.49	1.67	1.86	2.05	2.23	2.42	2.60	2.98
1/2	.850	1.06	1.275	1.49	1.70	1.91	2.12	2.34	2.55	2.76	2.98	3.40
9/16	.956	1.20	1.434	1.67	1.91	2.15	2.39	2.63	2.87	3.11	3.35	3.83
5/8	1.06	1.33	1.594	1.86	2.13	2-39	2.65	2.92	3.19	3.45	3.72	4.25
11/16	1.17	1.46	1.753	2.05	2.34	2.63	2.92	3.21	3.51	3.80	4.09	4.68
3/4	1.28	1.60	1.913	2.23	2.55	2.87	3.19	3.51	3.83	4.14	4.46	5.10
13/16	1.38	1.73	2.072	2.42	2.76	3.11	3.45	3.80	4.14	4.49	4.83	5.53
7/8	1.49	1.86	2.231	2.60	2.98	3.35	3.72	4.09	4.46	4.83	5.21	5.95
15/16	1.59	1.99	2.391	2.79	3.19	3.59	3.98	4.38	4.78	5.18	5.58	6.38
1	1.70	2.13	2.55	2.98	3.40	3.83	4.25	4.68	5.10	5.53	5.95	6.80
1⅛	1.91	2.38	2.87	3.35	3.83	4.30	4.78	5.26	5.74	6.22	6.69	7.65
1¼	2.13	2.65	3,19	3.72	4.25	4.78	5.31	5.84	6.38	6.91	7.44	8.50
1⅜	2.34	2.92	3.51	4.09	4.68	5,26	5.84	6.43	7.01	7.60	8.18	9.35
1½	2.55	3.19	3.83	4.46	5.10	5.74	6.38	7.01	7.65	8.29	8.93	10.20
1⅝	2.76	3.45	4.14	4.83	5.52	6.22	6.90	7.60	8.29	8.98	9.67	11.05
1¾	2.98	3.72	4.46	5.21	5.95	6.69	7.44	8.18	8.93	9.67	10.41	11.90
1⅞	3.19	3.98	4.78	5.58	6.38	7.17	7.97	8.77	9.56	10.36	11.16	12.75
2	3.40	4.25	5.10	5.95	6.80	7.65	8.50	9.35	10.20	11.05	11.90	13.60

These figures are the theoretical weights based on 489.6 lbs. per cubic foot of steel. Iron will run about 2 per cent. lighter.

From Joseph T. Ryerson & Son

WEIGHT OF FLAT ROLLED STEEL—POUNDS PER LINEAL FOOT

Thickness Inches	WIDTH—INCHES											
	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5
3/16	1.43	1.59	1.75	1.91	2.07	2.23	2.39	2.55	2.71	2.87	3.03	3.19
1/4	1.91	2.13	2.34	2.55	2.76	2.98	3.19	3.40	3.61	3.83	4.04	4.25
5/16	2.39	2.66	2.92	3.19	3.45	3.72	3.98	4.25	4.52	4.78	5.05	5.31
3/8	2.87	3.19	3.51	3.83	4.14	4.46	4.78	5.10	5.42	5.74	6.06	6.38
7/16	3,35	3.72	4.09	4.46	4.83	5.21	5.58	5.95	6.32	6.69	7.07	7.44
1/2	3.83	4.25	4.68	5.10	5.53	5.95	6.38	6.80	7.22	7.65	8.08	8.50
9/16	4.30	4.78	5.26	5.74	6.22	6.69	7.17	7.65	8.13	8.61	9.08	9.56
5/8	4.78	5.31	5.84	6.38	6.91	7.44	7.97	8.50	9.03	9.56	10.09	10.63
11/16	5.26	5.84	6.43	7.01	7.60	8.18	8.77	9.35	9.93	10.52	11.10	11.69
3/4	5.76	6.38	7.01	7.65	8.29	8.93	9.56	10.20	10.84	11.48	12.11	12.75
13/16	6.22	6.91	7.60	8.29	8.98	9.67	10.36	11.05	11.74	12.43	13.12	13.81
7/8	6.69	7.44	8.18	8.93	9.67	10.41	11.16	11.90	12.64	13.39	14.13	14.88
15/16	7.17	7.97	8.77	9.56	10.36	11.16	11.95	12.75	13.55	14.34	15.14	15.94
1	7.65	8.50	9.35	10.20	11.05	11.90	12.75	13.60	14.45	15.30	16.15	17.00
1⅛	8.61	9.56	10.52	11.48	12.43	13.39	14.34	15.30	16.26	17.21	18.17	19.13
1¼	9.56	10.63	11.69	12.75	13.81	14.88	15.94	17.00	18.06	19.13	20.19	21.25
1⅜	10.52	11.69	12.86	14.03	15.19	16.36	17.53	18.70	19.87	21.04	22.21	23.38
1½	11.48	12.75	14.03	15.30	16.58	17.85	19.13	20.40	21.68	22.95	24.23	25.50
1⅝	12.43	13.81	15.19	16.58	17.96	19.34	20.72	22.10	23.48	24.86	26.24	27,63
1¾	13.39	14.88	16.36	17.85	19.34	20.83	22.31	23.80	25.29	26.78	28.26	29.75
1⅞	14.34	15.94	17.53	19.13	20.72	22.31	23.91	25.50	27.09	28.69	30.28	31.88
2	15.30	17.00	18.70	20.40	22.10	23.80	25.50	27.20	28.90	30.60	32.30	34.00

These figures are the theoretical weights based on 489.6 lbs. per cubic foot **of steel.** **Iron will run** about 2 per cent. lighter.

From Joseph T. Ryerson & Son

WEIGHT OF FLAT ROLLED STEEL—POUNDS PER LINEAL FOOT

Thick-ness Inches	WIDTH—INCHES											
	5¼	5½	5¾	6	6¼	6½	6¾	7	7¼	7½	7¾	8
3/16	3.35	3.51	3.67	3 83	3.98	4.14	4.30	4.46	4.62	4.78	4.94	5.10
1/4	4.46	4.68	4.89	5.10	5.31	5.53	5.74	5.95	6.16	6.38	6.59	6.80
5/16	5.58	5 84	6.11	6.38	6.64	6.91	7.17	7.44	7.70	7.97	8.23	8.50
3/8	6.69	7.01	7.33	7.65	7.97	8,29	8.61	8.93	9.24	9.56	9.88	10.20
7/16	7.81	8.18	8.55	8.93	9.30	9.67	10.04	10.41	10.78	11.16	11.53	11.90
1/2	8.93	9.35	9.78	10.20	10.63	11.05	11.48	11.90	12.33	12.75	13.18	13.60
9/16	10.04	10.52	11.00	11.48	11.95	12.43	12.91	13.39	13.87	14.34	14.82	15.30
5/8	11.16	11.69	12.22	12.75	13.28	13.81	14.34	14.88	15.41	15.94	16.47	17.00
11/16	12.27	12.86	13.44	14.03	14.61	15.19	15.78	16.36	16.95	17.53	18.12	18.70
3/4	13.39	14.03	14.67	15.30	15.94	16.58	17.21	17.85	18.49	19.13	19 76	20.40
13/16	14.50	15.19	15.88	16.58	17.27	17.96	18.65	19,34	20.03	20.72	21.41	22.10
7/8	15.62	16.36	17.11	17 85	18.59	19.34	20.08	20.83	21.57	22.31	23.06	23.80
15/16	16.73	17,53	18.33	19.13	19.92	20.72	21.52	22.31	23.11	23.91	24.70	25.50
1	17.85	18.70	19.55	20.40	21.25	22.10	22.95	23.80	24.65	25.50	26.35	27.20
1⅛	20.08	21.04	21.99	22.95	23.91	24.86	25.82	26.78	27.73	28.69	29.64	30.60
1¼	22.31	23.38	24.44	25.50	26.56	27.63	28.69	29.75	30.81	31.88	32.94	34.00
1⅜	24.54	25.71	26.88	28.05	29.22	30.39	31.56	32.73	33.89	35.06	36.23	37.40
1½	26.78	28.05	29.33	30.60	31.88	33.15	34.43	35.70	36.98	38.25	39.53	40.80
1⅝	29.01	30.39	31.77	33.15	34.53	35.91	37.29	38.68	40.06	41.44	42.82	44.20
1¾	31.24	32.73	34.21	35.70	37.19	38.68	40.16	41.65	43.14	44.63	46.11	47.60
1⅞	33.47	35.06	36.66	38.25	39.85	41.44	43.03	44.63	46.22	47.81	49.41	51.00
2	35.70	37.40	39.10	40.80	42.50	44.20	45.90	47.60	49.30	51.00	52.70	54.40

These figures are the theoretical weights based on 489.6 lbs. per cubic foot of steel. Iron will run about 2 per cent. lighter.

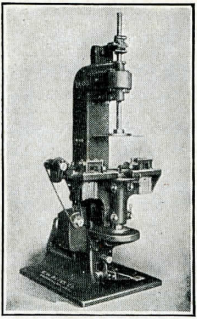
From Joseph T. Ryerson & Son

WEIGHT OF FLAT ROLLED STEEL—POUNDS PER LINEAL FOOT

Thick-ness Inches	WIDTH—INCHES											
	8¼	8½	8¾	9	9¼	9½	9¾	10	10¼	10½	11	12
3/16	5.26	5.42	5.58	5.74	5.90	6.06	6.22	6.38	6.53	6.69	7.01	7.65
1/4	7.01	7.23	7.44	7.65	7.86	8.08	8.29	8.50	8.71	8.93	9.35	10.20
5/16	8.77	9.03	9.30	9.56	9.83	10.09	10.36	10.63	10.89	11.16	11.69	12.75
3/8	10.52	10.84	11.16	11.48	11.79	12.11	12.43	12.75	13.07	13.39	14.03	15.30
7/16	12.27	12.64	13.02	13.39	13.76	14.13	14.50	14.88	15.25	15.62	16.36	17.85
1/2	14.03	14.45	14.88	15.30	15.73	16.15	16.58	17.00	17.43	17.85	18.70	20.40
9/16	15.78	16.26	16.73	17.21	17.69	18.17	18.65	19.13	19.60	20.08	21.04	22.95
5/8	17.53	18.06	18.59	19.13	19.66	20.19	20.72	21.25	21.78	22.31	23.38	25.50
11/16	19.28	19.87	20.45	21.04	21.62	22.21	22.79	23.38	23.96	24.54	25.71	28.05
3/4	21.04	21.68	22.31	22.95	23.59	24.23	24.86	25.50	26.14	26.78	28.05	30.60
13/16	22.79	23.48	24.17	24.86	25.55	26.24	26.93	27.63	28.32	29.01	30.39	33.15
7/8	24.54	25.29	26.03	25.78	27.52	28.26	29.01	29.75	30.49	31.24	32.73	35.70
15/16	26.30	27.09	27.89	28.69	29.48	30.28	31.08	31.88	32.67	33.47	35.06	38.25
1	28.05	28.90	29.75	30.60	31.45	32.30	33.15	34.00	34.85	35.70	37.40	40.80
1⅛	31.56	32.51	33.47	34.43	35.38	36.34	37.29	38.25	39.21	40.16	42.08	45.90
1¼	35.06	36.13	37.19	38.25	39.31	40.38	41.44	42.50	43.56	44.63	46.75	51.00
1⅜	38.57	39.74	40.91	42.08	43.24	44.41	45.58	46.75	47.92	49.09	51.43	56.10
1½	42.08	43.35	44.63	45.90	47.18	48.45	49.73	51.00	52.28	53.55	56.10	61.20
1⅝	45.58	46.96	48.34	49.73	51.11	52.49	53.87	55.25	56.63	58.01	60.78	66.30
1¾	49.09	50.58	52,06	53.55	55.04	56.53	58.01	59.50	60.99	62.48	65.45	71.40
1⅞	52.59	54.19	55.78	57.38	58.97	60.56	62.16	63.75	65.34	66.94	70.13	76.50
2	56.10	57.80	59.50	61.20	62.90	64.60	66.30	68.00	69.70	71.40	74.80	81.60

These figures are the theoretical weights based on 489.6 lbs. per cubic foot of steel. Iron will run about 2 per cent. lighter.

From Joseph T. Ryerson & Son



"BLISS" DOUBLE-SEAMING MACHINES

Simple, compact, high speed machines for double-seaming the ends on irregular shaped cans. This machine is semi automatic, leaving the operator nothing to do but place the can and depress the treadle. More than 30 types and sizes to meet every requirement

FACTORS OF SAFETY

Material	Steady Stress	Varying Stress	
		In One Direction	Tension and compression alternately
Cast Iron	5	10	20
Wrought Iron	4	7	14
Machine Steel	4	6	12
White Pine	8	12	20
Stone or Brick	50	75	—

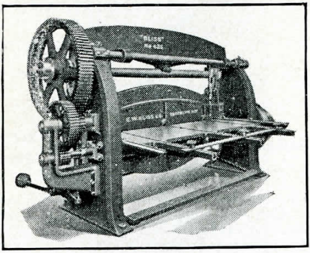
Add 50% to the above factors when the stress is applied in the nature of violent shocks.

AVERAGE ULTIMATE STRENGTH OF COMMON METALS

Pounds Per Square Inch

MATERIAL	Tension	Compress'n	Shear	Modulus of Elasticity
Aluminum	15,000	12,000	12,000	11,000,000
Brass, Cast	24,000	30,000	36,000	9,000,000
Bronze, Gun Metal	32,000	20,000		10,000,000
Bronze, Manganese	60,000	120,000		
Bronze, Phosphor	50,000			14,000,000
Copper, Cast	24,000	40,000	30,000	10,000,000
Copper Wire, annealed	36,000			15,000,000
Copper Wire, unannealed	60,000			18,000,000
Iron, Cast	15,000	80,000	18,000	12,000,000
Iron Wire, annealed	60,000			15,000,000
Iron Wire, unannealed	80,000			25,000,000
Iron, Wrought	48,000	46,000	40,000	27,000,000
Lead, Cast	2,000			1,000,000
Steel Castings	70,000	70,000	60,000	30,000,000
Steel, Plow	270,000			
Steel, Structural	60,000	60,000	50,000	29,000,000
Steel Wire, annealed	80,000			29,000,000
Steel Wire, unannealed	120,000			30,000,000
Steel Wire, Crucible	180,000			30,000,000
Steel Wire, Susp. Bridge	200,000			30,000,000
Steel Wire, Piano	300,000			
Tin, Cast	3,500	6,000		4,000.000
Zinc, Cast	5,000	20,000		3,000,000

From Industrial Press "Machinery."

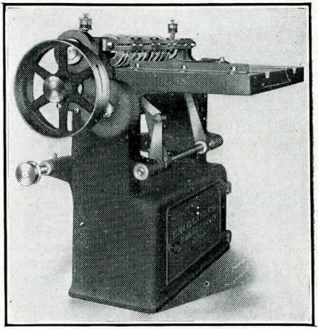


"BLISS" SQUARING AND TRIMMING SHEARS.—Built in over 30 styles and sizes, weighing from 450 to 16,000 lbs. For cutting sheet metal up to 50 in. long by foot power, and up to 98 in. long and up to ¼ in. thick by power.

TRANSVERSE OR SHEARING STRENGTH OF MATERIALS

As in tensile strength, the values for shearing depend upon the quality of the material. For metals generally the shearing can be taken from 68 to 100 per cent. of the tensile strength.

	Approx. Shearing Strength in tons per Sq. In.	Percentage of Tensile Strength
Crucible Steel.......	27	68
Bessemer Steel.....	25	80
Wrought Iron.......	19	85
Cast Iron..............	9	100



"BLISS" GANG SLITTERS—We build these machines in a large number of sizes for various widths and thicknesses of stock. The machine illustrated will trim sheets 32″ in width, and slit strips down to 2″ in width. We guarantee the machine to slit "dead true."

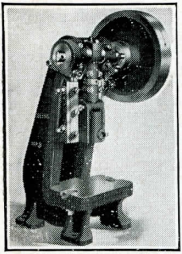
MAXIMUM WORKING STRESS FOR CAST IRON, WROUGHT IRON, AND STEEL

(According to nature of Stress and Load)

Material	Constant Load		Variable Load			
	Stress	Tons per Sq. In.	Stress	Tons per Sq. In.	Stress	Tons per Sq. In.
W. I.	T.	5	T.	3	T. and C. Alt.	1½
	C.	4	C.	2½		
M. S.	T.	8	T.	5	T. and C. Alt.	2½
	C.	12	C.	7½		
C. I.	T.	1¼	T.	¾	T. and C. Alt.	¾
	C.	6	C.	4½		

Practical Engineer

NOTE. W. I.=Wrought Iron. M. S.=Mild Steel. C. I.=Cast Iron. T.=Tension. C.=Compression. Alt.=Alternate.



"BLISS" NO. 8 BENCH PRESS—This press is particularly adapted for light work to take the place of foot presses. It is used in the manufacture of burners, light jewelry work, etc., for small hole punching, blanking and forming; weight, 250 lbs.

PRESSURES IN LBS. (APPROXIMATE ONLY) REQUIRED FOR PUNCHING DIFFERENT THICKNESSES OF STEEL, HIGH CARBON STEEL AND BRASS PLATE

Formula: Length × Thickness × Shearing Strength of Material Lbs.

Shearing strength per sq. inch of Steel = 50,000

Shearing strength per sq. inch of High Carbon Steel.............................. = 75,000

Shearing strength per sq. inch of Brass = 35,000

No. of Gauge U. S. St'd Plate	Figured for 1 Inch Diameter Hole Without Shear on Dies		
	Steel	High Car. St.	Brass
	Lbs.		Lbs.
28	2,454	3,681	1,718
24	3,927	5,890	2,749
20	5,890	8,835	4,123
18	7,854	11,781	5,498
16	9,817	14,726	6,872
13	14,765	22,148	10,335
11	19,635	29,452	13,744
3/16	29,452	44,178	20,616
¼	39,270	58,905	27,489
5/16	49,087	73,631	34,361
⅜	58,905	88,357	41,233
7/16	68,722	103,080	48,104
½	78,540	117,810	54,978
⅝	98,175	147,262	68,722
¾	117,810	176,715	82,467
⅞	137,445	206,167	96,211
1	157,080	235,620	109,956

This table is figured for one inch diameter. If pressure for smaller or larger diameter is required, multiply or divide as the case may be.

PRESSURES IN LBS. (APPROXIMATE ONLY) REQUIRED FOR SHEARING DIFFERENT THICKNESSES OF STEEL, HIGH CARBON STEEL, AND BRASS PLATE

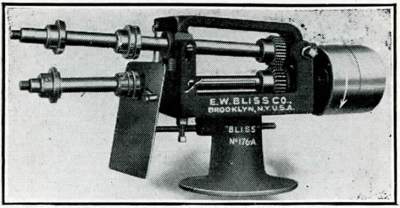
Formula:

Length × Thickness × Shearing Strength of Material

	Lbs.
Shearing strength per sq. in. of Steel	= 50,000
Shearing strength per sq. in. of High Carbon Steel..............................	= 75,000
Shearing strength per sq. in. of Brass	= 35,000

No. of Gauge U.S. St'd Plate	Figured for 1″ Length Without Shear on Dies		
	Steel	High Car. Steel	Brass
28	780	1,170	546
24	1,250	1,875	875
20	1,875	2,812	1,312
18	2,500	3,750	1,750
16	3,125	4,687	2,187
13	4,700	7,050	3,290
11	6 250	9,375	4,375
3/16	9,375	14,062	6,562
¼	12,500	18,750	8,750
5/16	15,625	23,437	10,937
⅜	18,750	28,125	13,125
7/16	21,875	32,812	15,312
½	25,000	37,500	17,500
⅝	31,250	46,875	21,875
¾	37,500	56,250	26,250
⅞	43,750	65,625	30,625
1	50,000	75 000	35,000

As most tools are sheared, the above pressure can be taken at one-half as given in table up to ¼″ thickness in stock. Beyond ¼″ up to 1″, not less than two-thirds of the above given pressures should be taken for safe figuring on suitable press.



"BLISS" No. 176-A BEADING AND FLANGING MACHINE—Adapted for beading and flanging a wide variety of straight and taper work.

APPROXIMATE DIE CLEARANCE BETWEEN PUNCH AND DIE ON DIAMETER

FORMULA:

Clearance for brass and soft steel, thickness of stock divided by 10.

Clearance for hard rolled steel, thickness of stock divided by 8.

No. of Gauge U. S. Standard for Plate	Clearance for Brass and Soft Steel	Clearance for Hard Rolled Steel
28	.0015	.0019
24	.0025	.0031
20	.0037	.0046
18	.005	.0062
16	.0062	.0078
13	.0093	.0117
11	.0125	.0156
3/16	.0187	.0234
1/4	.025	.0312
5/16	.0312	.039
3/8	.0375	.0468
7/16	.0437	.0546
1/2	.050	.0625
5/8	.0625	.0781
3/4	.075	.0937
7/8	.0875	.1093
1	.10	.125

NOTE: For cutting blanks to exact size make die—.002 smaller than diameter required, allow clearance on punch and shear die. For punching holes to exact size make punch .002 larger than diameter of hole required, allow clearance on die and shear punch.

WEIGHT OF WIRE

Weight of 100 Lineal Feet

B. W. Gauge	Iron	Steel	Brass	Copper
	Lbs.	Lbs.	Lbs.	Lbs.
0	30.58	30.92	33.43	35.17
1	25.75	26.04	28.15	29.62
2	21.34	21.57	23.32	24.54
3	18.02	18.22	19.70	20.72
4	15.11	15.28	16.52	17.38
5	12.46	12.59	13.62	14.33
6	11.45	11.57	12.51	13.16
7	9.25	9.35	10.11	10.64
8	7.29	7.37	7.97	8.38
9	6.60	6.68	7.22	7.59
10	4.96	5.02	5.43	5.71
11	4.13	4.18	4.52	4.75
12	3.14	3.18	3.43	3.61
13	2.34	2.36	2.55	2.69
14	1.69	1.71	1.85	1.95
15	1.37	1.39	1.50	1.58
16	1.05	1.06	1.15	1.21
17	.804	.815	.877	.928
18	.612	.622	.674	.704
19	.471	.478	.510	.547
20	.326	.331	.342	.372
21	.271	.274	.293	.310
22	.208	.210	.224	.237
23	.166	.167	.179	.189
24	.128	.129	.138	.147
25	.106	.107	.114	.121
26	.086	.087	.093	.098
27	.068	.069	.073	.078
28	.052	.053	.056	.059
29	.045	.046	.048	.051
30	.038	.039	.041	.044

SQUARES, CUBES, SQUARE ROOTS AND CUBE ROOTS

No.	Squares	Cubes	Square Roots	Cube Roots
1	1	1	1.0000	1.0000
2	4	8	1.4142	1.2599
3	9	27	1.7320	1.4422
4	16	64	2.0000	1.5874
5	25	125	2.2360	1.7099
6	36	216	2.4494	1.8171
7	49	343	2.6457	1.9129
8	64	512	2.8284	2.0000
9	81	729	3.0000	2.0800
10	100	1000	3.1622	2.1544
11	121	1331	3.3166	2.2239
12	144	1728	3.4641	2.2894
13	169	2197	3.6055	2.3513
14	196	2744	3.7416	2.4101
15	225	3375	3.8729	2.4662
16	256	4096	4.0000	2.5198
17	289	4913	4.1231	2.5712
18	324	5832	4.2426	2.6207
19	361	6859	4.3588	2.6684
20	400	8000	4.4721	2.7144
21	441	9261	4.5825	2.7589
22	484	10648	4.6904	2.8020
23	529	12167	4.7958	2.8434
24	576	13824	4.8989	2.8844
25	625	15625	5.0000	2.9240

SQUARES, CUBES, SQUARE ROOTS AND CUBE ROOTS—Continued

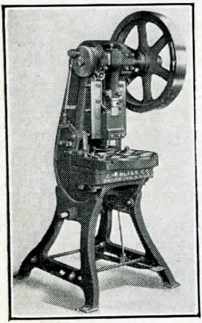
No.	Squares	Cubes	Square Roots	Cube Roots
26	676	17576	5.0990	2.9624
27	729	19683	5.1961	3.0000
28	784	21952	5.2915	3.0365
29	841	24389	5.3851	3.0723
30	900	27000	5.4772	3.1072
31	961	29791	5.5677	3.1413
32	1024	32768	5.6568	3.1748
33	1089	35937	5.7445	3.2075
34	1156	39304	5.8309	3.2396
35	1225	42875	5.9160	3.2710
36	1296	46656	6.0000	3.3019
37	1369	50653	6.0827	3.3322
38	1444	54872	6.1644	3.3619
39	1521	59319	6.2444	3.3912
40	1600	64000	6.3245	3.4199
41	1681	68921	6.4031	3.4482
42	1764	74088	6.4807	3.4760
43	1849	79507	6.5574	3.5033
44	1936	85184	6.6332	3.5303
45	2025	91125	6.7082	3.5568
46	2116	97336	6.7823	3.5830
47	2209	103823	6.8556	3.6088
48	2304	110592	6.9282	3.6342
49	2401	117649	7.0000	3.6593

SQUARES, CUBES, SQUARE ROOTS AND CUBE ROOTS—Continued

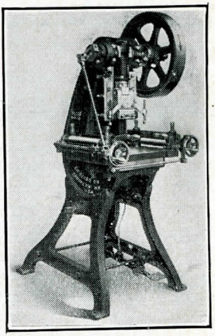
No.	Squares	Cubes	Square Roots	Cube Roots
50	2500	125000	7.0710	3.6840
51	2601	132651	7.1414	3.7084
52	2704	140608	7.2111	3.7325
53	2809	148877	7.2801	3.7562
54	2916	157464	7.3484	3.7797
55	3025	166375	7.4161	3.8029
56	3136	175616	7.4833	3.8258
57	3249	185193	7.5498	3.8485
58	3364	195112	7.6157	3.8708
59	3481	205379	7.6811	3.8928
60	3600	216000	7.7459	3.9148
61	3721	226981	7.8102	3.9364
62	3844	238328	7.8740	3.9578
63	3969	250047	7.9372	3.9790
64	4096	262144	8.0000	4.0000
65	4225	274625	8.0622	4.0207
66	4356	287496	8.1240	4.0412
67	4489	300763	8.1853	4.0615
68	4624	314432	8.2462	4.0816
69	4761	328509	8.3066	4.1015
70	4900	343000	8.3666	4.1212
71	5041	357911	8.4261	4.1408
72	5184	373248	8.4852	4.1601
73	5329	389017	8.5444	4.1793
74	5476	405224	8.6023	4.1983
75	5625	421875	8.6602	4.2171

SQUARES, CUBES, SQUARE ROOTS AND CUBE ROOTS—Continued

No.	Squares	Cubes	Square Roots	Cube Roots
76	5776	438976	8.7177	4.2358
77	5929	456533	8.7749	4.2543
78	6084	474552	8.8317	4.2726
79	6241	493039	8.8881	4.2908
80	6400	512000	8.9442	4.3088
81	6561	531441	9.0000	4.3267
82	6724	551368	9.0553	4.3444
83	6889	571787	9.1104	4.3620
84	7056	592704	9.1651	4.3795
85	7225	614125	9.2195	4.3968
86	7396	636056	9.2736	4.4140
87	7569	658503	9.3273	4.4310
88	7744	681472	9.3808	4.4479
89	7921	704969	9.4339	4.4647
90	8100	729000	9.4868	4.4814
91	8281	753571	9.5393	4.4979
92	8464	778688	9.5916	4.5143
93	8649	804357	9.6436	4.5306
94	8836	830584	9.6953	4.5468
95	9025	857375	9.7467	4.5629
96	9216	884736	9.7975	4.5788
97	9409	912673	9.8488	4.5947
98	9604	941192	9.8994	4.6104
99	9801	970299	9.9498	4.6260
100	10000	1000000	10.0000	4.6415



"BLISS" PRESS WITH DIAL FEED



"BLISS" PRESS WITH DOUBLE-ROLL FEED

AUTOMATIC FEEDS.—"Bliss" presses are built with many different types of Automatic feeds. The style of feed depending on the character of work. The above illustrations show two standard types in general use. We will be glad to make suggestions regarding special feeds to suit your requirements.

MELTING POINTS OF METALS, IN FAHRENHEIT

	Degrees
Alloy, 3 Lead, 2 Tin, 5 Bismuth	200
Alloy, 1 Tin, 1 Lead	370–460
Aluminum	1,160
Aluminum Bronze	1,700
Antimony	950
Bismuth	510
Brass	1,870
Bronze	1,690
Copper	2,000

(Continued on next page.)

MELTING POINTS OF METALS, IN FAHRENHEIT—Continued

		Degrees
Gold		2,020
Iron, Cast	white	2,075
	gray	2,264
Iron, Wrought		3,000-3,500
Lead		610
Magnesium		1,200
Mercury		—39
Platinum		3,500
Steel		2,370-2,550
Silver		1,860
Tin		445
Zinc		700

WEIGHT AND SPECIFIC GRAVITY OF METALS

	Wt. per Cubic Ft. Pounds	Wt. Per Cubic In. Pound	Specfic Gravity
Aluminum	166	.096	2.67
Antimony	419	.242	6.72
Bismuth	613	.353	9.822
Brass, Cast	524	.3	8.4
Bronze	534	.308	8.561
Copper, Cast	537	.31	8.607
Copper Wire	555	.32	8.9
Gold, 24 Karat	1,208	.697	19.361
Gold, Standard	1,106	.638	17.724
Gun Metal	528	.304	8.459
Zinc	437	.252	7.
Iron, Cast	450	.26	7.21
Iron, Wrought	485	.28	7.78
Lead, Cast	708	.408	11.36
Lead, Rolled	711	.41	11.41
Mercury	849	.489	13.596
Platinum	1,344	.775	21.531
Platinum Sheet	1.436	.828	23.
Silver, Pure	654	.377	10.474
Silver, Standard	644	.371	10.312
Steel	490	.284	7.85
Tin, Cast	455	.262	7.291

TEMPERING STEEL—*Kent.*

Tempering steel is the act of giving it, after it has been shaped, the hardness necessary for the work it has to do. This is done by first hardening the piece, generally a good deal harder than is necessary, and then toughening it by slow heating and gradual softening until it is just right for the work.

A piece of steel properly tempered should always be finer in grain than the bar from which it is made. If it is necessary, in order to make the piece as hard as it is required, to heat it so hot that after being hardened the grain will be as coarse as or coarser than the grain in the original bar, then the steel itself is of too low carbon for the desired work.

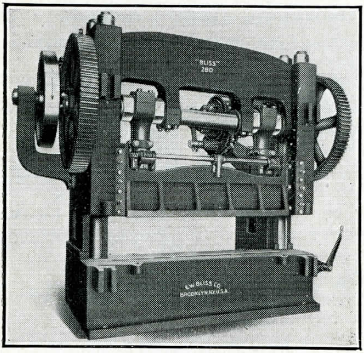
If a great degree of hardness is not desired, as in the case of taps, and most tools of complicated form, and it is found that at a moderate heat the tools are too hard and liable to crack, the smith should first use a lower heat in order to save the tools already made, and then notify the steelmaker that his steel is too high, so as to prevent a recurrence of the trouble.

For tempering of steel, the following is a list of the tools in their order on the color scale, together with the approximate color and the temperature at which the color appears on brightened steel when heated in the air:

(Continued on page 107)

TEMPERING STEEL—Continued. *Kent.*

Very pale yellow, 430° F.
Scrapers for brass.
Steel Engraving tools.
Slight turning tools.
Hammer faces.
Planer tools for steel.
Ivory-cutting tools.
Planer tools for iron.
Paper cutters.
Wood-engraving tools.
Bone-cutting tools.
Straw yellow, 460° F.
Milling-cutters.
Wire-drawing dies.
Boring-cutters.
Leather cutting dies.
Screw-cutting dies.
Inserted saw teeth.
Taps.
Rock-drills.
Penknives.
Reamers.
Half-round bits,
Planing and moulding cutters.
Brown yellow, 500° F.
Stone-cutting tools.
Gouges.
Hand-plane irons.
Twist-drills.
Flat drills for brass.
Wood-boring cutters.
Drifts.
Coopers' tools.
Light purple. 530° F.
Edging cutters.
Augers.
Dental and Surgical Instruments.
Cold chisels for steel.
Purple, 550° F.
Axes, dark.
Gimlets.
Cold chisels for cast iron.
Saws for bone and ivory.
Needles.
Firmer-chisels.
Hack-saws.
Framing-chisels.
Moulding and planing cutters to be filed.
Circular saws for metal.
Screw-drivers.
Springs.
Saws for wood.
Dark blue, 570° F.
Pale blue, 610° F.
Blue tinged with green, 630° F.



"BLISS" AND "STILES" OVERHANGING DOUBLE-CRANK PRESSES.—Built in over 100 different types and sizes, weighing from 2300 to 280,000 lbs. For heavy blanking, stamping and punching of large dimensions, etc.

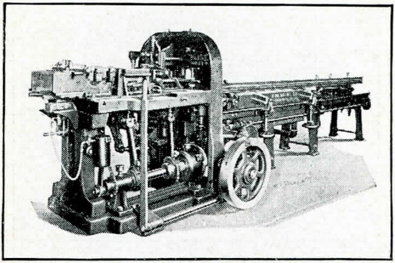
The press illustrated is of tie-rod construction, is arranged with double drive and has a bed area of 24 x 118 inches. Weight 80,500 pounds.

CASE HARDENING

This process gives to wrought iron a surface having the properties of steel, and parts subjected to friction are enabled to withstand considerably more wear. The depth to which the hardening may extend is from 1/16 to 1/8 inch. To case-harden, the polished surface is heated to a cherry red and then placed in a mixture of charcoal and soda ash, or ferrocyanide of potassium and pieces of leather.

UNITED STATES STANDARD BOLTS AND NUTS

Diameter of Bolt Inches	Area at Bottom of Thread	Tensile Strength at 10,000 Pounds per Square Inch	Threads per Inch	Thickness of Head	Thickness of Nut	Weight Each Square Nut	Weight Each Hexagon Nut	Weight per Inch Length of Bolt
¼	.0269	269	20	¼	¼	.0138	.0131	.0136
5/16	.0454	454	18	19/64	5/16	.0231	.0192	.0213
⅜	.0678	678	16	11/32	⅜	.0426	.0333	.0306
7/16	.0933	933	14	25/64	7/16	.0613	.0500	.0417
½	.1257	1,257	13	7/16	½	.0893	.0700	.0545
⅝	.2018	2,018	11	17/32	⅝	.1560	.1350	.0852
¾	.3020	3,020	10	⅝	¾	.2630	.2220	.1227
⅞	.4193	4,193	9	23/32	⅞	.3570	.3240	.1670
1	.5510	5,510	8	13/16	1	.5880	.4630	.2181
1⅛	.6931	6 931	7	29/32	1⅛	.7690	.6760	.2760
1¼	.8899	8 899	7	1	1¼	1.04	.9010	.3410
1⅜	1.0541	10,541	6	1 3/32	1⅜	1.43	1.18	.4120
1½	1.2938	12,938	6	1 3/16	1½	1.72	1.47	.4900
1¾	1.7441	17,441	5	1⅜	1¾	2.94	2.50	.6680
2	2.3001	23,001	4½	1 9/16	2	4.35	3.45	.8720



CAN-MAKING MACHINERY

We furnish complete equipments of Automatic or Semi-Automatic Machinery for the manufacture of Sanitary Cans, Packers' Cans, and Tin packages of every description. These machines embody the latest and best ideas brought out by experiment and by actual use. We will be pleased to answer any inquiries, or send pamphlet describing these machines on request.

The machine illustrated, "BLISS" No. 22-N Automatic Sanitary Can Body Maker with Precision Feed and Roll Solder Attachment, turns flat blanks into completed and soldered bodies for round cans at the rate of 150 or more per minute. It can also be used for square, oblong or oval can bodies. The side-seam soldering attachment may be operated independently of the body maker. This machine is fully patented.

FLUXES FOR SOLDERING OR WELDING

Iron	Borax
Tinned Iron	Resin
Copper and Brass	Sal ammoniac
Zinc	Chloride of Zinc
Lead	Tallow of Resin
Lead and Tin Pipes	Resin and Sweet Oil

Steel:—Pulverize together 1 part of sal ammoniac and 10 parts of borax and fuse until clear. When solidified, pulverize to powder.

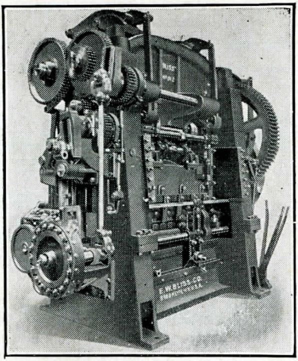
SOFT AND HARD SOLDERS FOR VARIOUS METALS

Metal to be Soldered	FLUX	Soft Solder		
		Tin	Lead	Other Constituents*
Aluminum	Stearin	70	......	Zn-25 Al-3 P.Tin-2
Brass	Chloride of Zinc, Rosin or Chloride of Ammonia	66	34	....
Gun Metal		63	37	....
Copper		60	40	....
Lead	Tallow or Rosin	33	67	....
Block Tin	Chloride of Zinc	99	1	....
Tinned Steel	Chloride of Zinc or Rosin	64	36	....
Galvanized Steel	Hydrochloric Acid	58	42	....
Zinc	Hydrochloric Acid	55	45	....
Pewter	Gallipoli Oil	25	25	Bi-50
Iron and Steel	Chloride of Ammonia	50	50	....
Gold	Chloride of Zinc	67	33	....
Silver	Chloride of Zinc	67	33	....
Bismuth	Chloride of Zinc	33	33	Bi-34

***Zn=Zinc Al=Aluminum P-Tin=Phosphor Tin Bi=Bismuth**

Metal to be Soldered	FLUX	Hard Solder			
		Copper	Zinc	Silver	Gold
Brass, Soft	Borax	22	78	....	......
Brass, Hard	Borax	45	55	....	......
Copper	Borax	50	50	....	......
Gold	Borax	22	....	11	67
Silver	Borax	20	10	70	......
Cast Iron	Cuprous Oxide	55	45	....	......
Iron&Steel	Borax	64	36	....	......

From Industrial Press "Machinery"



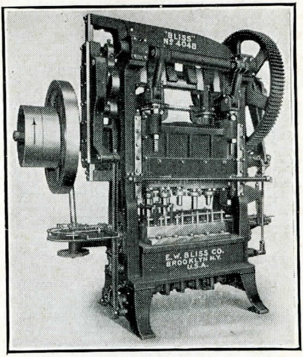
"BLISS" DOUBLE-ROLL FEED PERFORATING PRESSES.—Built in a number of sizes are adapted for gang punching work, such as plates for boilers and tanks or other large sheet metal articles and perforated sheets requiring a large number of perforations. Weights 25,000 to 75,000 lbs.

ALUMINUM SOLDER

An aluminum solder that is sometimes used is composed of 75.5 parts (by weight) of tin; 18 parts of zinc; and 2.5 parts of aluminum. No flux is needed. It is advisable to slightly heat the parts to be soldered. Another aluminum solder is composed of 80% tin and 20% zinc, stearic acid being used as a flux.

SOLDERING STEEL TO CAST IRON

To solder steel to cast iron, first copperize the cast-iron surface with vitriol. It is necessary that the cast-iron surface be thoroughly cleaned and polished before the vitriol is put onto it. After having applied the vitriol, allow the surface to dry thoroughly and then solder the steel to the copperized surface the same as in ordinary soldering.



"BLISS" DOUBLE-CRANK TOGGLE DRAWING PRESS WITH AUTOMATIC FEEDS—Arranged as shown above this type of press is specially adapted for the rapid and economical production of articles which require a series of operations; such as lamp and lantern bodies, lamp founts, drinking cups, oil can bodies, etc.

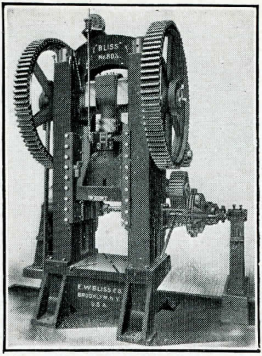
The number of operations which may be done simultaneously at each stroke is limited to the number that may be done without annealling.

ANTI-RUST COMPOUND FOR MACHINERY

Dissolve 1 oz. camphor in 1 lb. melted lard, skim off and stir in about 3 oz. powdered graphite. Clean the machinery and paint with a brush and allow 1 day to dry, then rub off the mixture with a soft cloth.

TO PREVENT BABBITT METAL FROM BLOWING OUT IN THE POURING

Heat the boxes to be lined if possible very slightly, and put into the melted babbitt a small piece of rosin (about ½ inch cube). The rosin should be allowed to melt after which the babbitt may be poured.



"BLISS" STRAIGHT-SIDE PRESSES—For trimming drop forgings, heavy stamping, punching, cutting, piercing, etc. Built in a large number of sizes with solid and tierod frames. Fly Wheel or Geared, weighing from 5,000 to 185,000 lbs. They are also built with long stroke and increased die space for broaching, re-drawing, etc.

METAL TO EXPAND IN COOLING

Nine parts Lead.
Two parts Antimony.
One part Bismuth.

CEMENT TO FILL HOLES IN CASTING

Powdered Cast Iron, 5 lbs.
Powdered Salammoniac, 2 ozs.
Powdered Sulphur, 1 oz.
Moisten with water to a paste.

TO SOFTEN HARD CAST IRON FOR DRILLING.—Heat the piece to a cherry red and put on the place to be drilled a piece of sulphur about the size of the hole to be drilled. This will soften the iron to a depth of about ⅓ inch.

ALLOWANCES FOR RUNNING AND FORCE FITS

Running Fits		Force Fits	
Diam. of Bearing	Diam. of Shaft	Diam. of Hole	Diam. of Shaft
1	.999	1	1.001
2	1.998	2	2.003
3	2.997	3	3.005
4	3.9965	4	4.006
5	4.9963	5	5.007
6	5.996	6	6.008
7	6.9958	7	7.0085
8	7.9958	8	8.009
9	8.9957	9	9.01
10	9.9956	10	10.0105
11	10.9955	11	11.011
12	11.9954	12	12.0115
13	12.9953	13	13.012
14	13.9952	14	14.013
15	14.9951	15	15.014
16	15.995	16	16.0145
17	16.9949	17	17.015
18	17.9948	18	18.0155
19	18.9947	19	19.016
20	19.9945	20	20.017

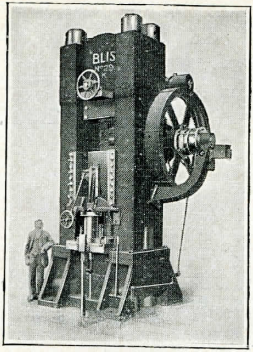
Allowance for drive fits are one-half that of force fits.

American Machinist.

CASTINGS

We are in a position to furnish Superior Quality Iron Castings, both Light and Heavy.

We furnish die castings of a special die mixture to manufacturers who finish their own dies.



"BLISS" KNUCKLE JOINT EMBOSSING PRESS.—Built in nine sizes for pressures ranging from 100 to 1500 tons. Heavy one piece frames are used on the four smallest sizes. Built up, tie-rod frames on the five largest.

PRESSURE REQUIRED FOR STAMPING U. S. COINS

Tests made by U. S. Mint, Philadelphia, Pa.

U. S. Coin	Metal	Tons Pressure
Double Eagle	Gold	155
Eagle	Gold	110
Half-eagle	Gold	60
Quarter-eagle	Gold	35
Standard dollar	Silver	160
Half-dollar	Silver	98
Quarter-dollar	Silver	60
Dime	Silver	35
5-cent nickel	Nickel	60
1 cent	Copper	40

M. M. ALLOWANCE FOR SHRINK FITS

Diameter of Wheel Center	Inside Diameter of Tire	Allowance for Shrinkage	Diameter of Wheel Center	Inside Diameter of Tire	Allowance for Shrinkage
20	19.979	.021	53	52.945	.055
21	20.978	.022	54	53.944	.056
22	21.977	.023	55	54.943	.057
23	22.976	.024	56	55.942	.058
24	23.975	.025	57	56.941	.059
25	24.974	.026	58	57.940	.060
26	25.973	.027	59	58.939	.061
27	26.972	.028	60	59.937	.063
28	27.971	.029	61	60.936	.064
29	28.970	.030	62	61.935	.065
30	29.969	.031	63	62.934	.066
31	30.968	.032	64	63.933	.067
32	31.967	.033	65	64.932	.068
33	32.966	.034	66	65.931	.069
34	33.965	.035	67	66.930	.070
35	34.964	.036	68	67.929	.071
36	35.962	.037	69	68.928	.072
37	36.961	.038	70	69.927	.073
38	37.960	.039	71	70.926	.074
39	38.959	.040	72	71.925	.075
40	39.958	.041	73	72.924	.076
41	40.957	.043	74	73.923	.077
42	41.956	.044	75	74.922	.078
43	42.955	.045	76	75.921	.079
44	43.954	.046	77	76.920	.080
45	44.953	.047	78	77.919	.081
46	45.952	.048	79	78.918	.082
47	46.951	.049	80	79.917	.083
48	47.950	.050	81	80.916	.084
49	48.949	.051	82	81.915	.085
50	49.948	.052	83	82.914	.086
51	50.947	.053	84	83.912	.088
52	51.946	.054			

From American Machinist

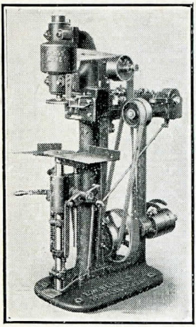


Fig. 1. No. 12.—SEMI-AUTOMATIC DOUBLE-SEAMER—For round work.

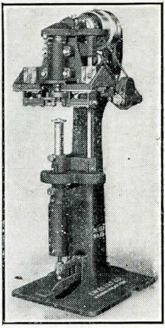


Fig. 2. No. 15.—SEMI-AUTOMATIC DOUBLE-SEAMER—For oblong, oval, square and irregular shapes.

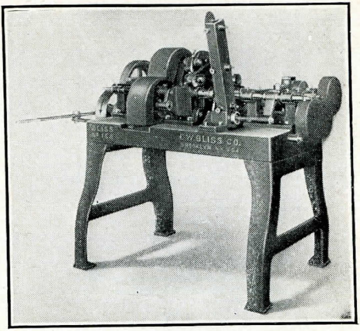
"BLISS" DOUBLE=SEAMERS—Built in over 30 different types and sizes, weighing from 275 to 7,500 lbs. For double-seaming the tops and bottoms on articles of square, round, oval and irregular shapes.

A GOOD SIMPLE METHOD FOR HEATING CHISELS, LATHE TOOLS, ETC.

Place a 3″ gas pipe on a forge. Cover same with coal. Keep turning your pipe until you get an even heat. Place your article inside and you can watch the tool while it is getting to the right degree of Fahrenheit for plunging into the liquid.

PROPORTION OF WEIGHT CAST IRON TO COMMON PATTERN LUMBER

Cast iron is approximately 17½ times heavier than ordinary kiln-dried wood used in common patterns.



"BLISS" AUTOMATIC TRIMMER AND BEADER.—Operating at a high rate of speed, this machine automatically trims and beads, trims and knurls or trims and threads shells from 1 to 3 inches in diameter by ¼ to 1¾ inches in depth. Weight 1400 lbs.

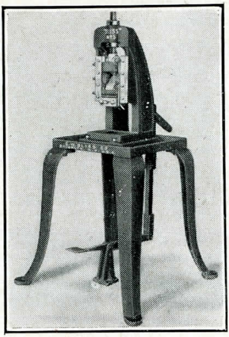
We build a large number of different sizes and styles of trimmers, beaders and thread-rolling machines. On receipt of samples we will be pleased to make recommendations regarding machines best adapted for the work.

SHRINKAGE OF CASTINGS.—*Kent.*

The allowance necessary for shrinkage varies for different kinds of metal, and the different conditions under which they are cast. For castings where the thickness runs about 1 inch, cast under ordinary conditions, the following allowance can be made.

Cast Iron,	1/8 in. per ft.	Brass,	3/16 in. per ft.
Mal. Iron,	1/8 in. " "	Steel,	1/4 in. " "
Aluminum,	3/16 in. " "	Zinc,	5/16 in. " "
Britannia,	1/32 in. " "	Tin,	1/12 in. " "

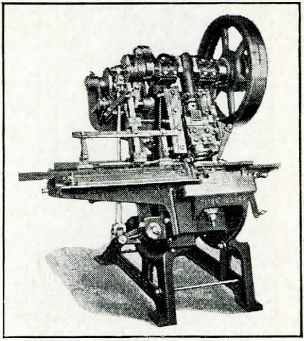
Thicker castings, under the same conditions will shrink less, and thinner ones more. The quality of the material and the manner of moulding and cooling will also make a difference.



FOOT, LEVER AND PENDULUM PRESSES—Built in 30 sizes and styles, weighing from 70 to 3,000 lbs. For cutting and shaping sheet-metal goods; also for jewelers' use.

SIZE ACROSS CORNERS OF SQUARES.

Size of Square. In.	Diagonal	Size of Square, In.	Diagonal
⅛	.177	1	1.4141
3-16	.265	1⅛	1.590
¼	.354	1¼	1.768
5-16	.442	1⅜	1.945
⅜	.530	1½	2.121
7-16	.619	1⅝	2.298
½	.707	1¾	2.475
9-16	.796	1⅞	2.652
⅝	.884	2	2.828
11-16	.972	2⅛	3.005
¾	1.061	2¼	3.182
13-16	1.149	2½	3.535
⅞	1.237	2¾	3.889
15-16	1.326	3	4.243



CAN MAKING MACHINERY

We furnish complete equipments of Automatic or Semi-Automatic Machinery for the manufacture of Sanitary Cans, Packers' Cans, and Tin packages of every description. We will on request, be pleased to answer inquiries, or send pamphlet describing these machines.

The press illustrated above is built in 6 sizes. It automatically cuts from strips the tops and bottoms used for both Sanitary and Packers' cans.

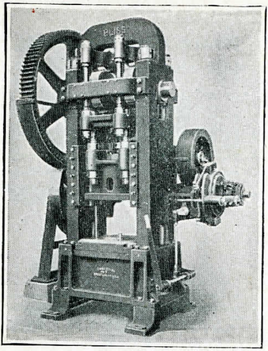
HYDRAULIC FORGINGS

We have exceptional facilities for making a superior grade of Hydraulic Seamless Steel Forgings, such as Bowls, Bottles, Cream Separator Bowls, Special Shapes, etc. We solicit your orders for this class of work.

HORSE POWER

To ascertain H. P. used in driving a machine by electric motor—

$$\frac{\text{AMPERES} \times \text{VOLTS}}{746} = \text{H. P.}$$



"BLISS" STRAIGHT-SIDE CAM DRAWING PRESS.—For simultaneously cutting and drawing articles from comparatively heavy stock. Also built in overhanging types.

METRIC SYSTEM

Measures of Weight. (*Unit Gramme.*)

	Grains.	Oz. Troy.	Lb. Avoir.	Cwt.
Centigramme,	0.15432	—	—	—
Decigramme,	1.54323	0.003	—	—
Gramme,	15.43235	0.032	0.002	—
Decagramme.	154.32349	0.321	0.022	—
Hectogramme,	1543.23488	3.215	0.220	0.002
Kilogramme,	15432.34880	32.150	2.204	0.019

Measures of Length. (*Unit Meter.*)

	Inches	Feet	Yds.	Mls.
Millimeter,	0.03937	0.003	0.001	—
Centimeter,	0.39371	0.032	0.011	—
Decimeter,	3.93708	0.328	0.109	—
Meter,	39.37079	3.280	1.093	—
Decameter,	393.70790	32.808	10.936	0.006
Hectometer,	3937.07900	328.090	109.363	0.062
Kilometer,	39370.79000	3280.899	1093.633	0.621

CONVENIENT FACTORS FOR CONVERSION

To Convert:			
Grain to Grammes,	multiply	by	.065
Ounces to Grammes,	"	"	28.35
Pounds to Grammes,	"	"	453.6
Pounds to Kilogrammes,	"	"	.45
Cwts. to Kilogrammes,	"	"	50.8
Tons to Kilogrammes,	"	"	1016.
Grammes to Grains,	"	"	15.4
Grammes to Ounces,	"	"	.035
Kilogrammes to Ounces,	"	"	35.3
Kilogrammes to Pounds,	"	"	2.2
Kilogrammes to Cwts.,	"	"	.02
Kilogrammes to Tons,	"	"	.001
Inches to Millimeters,	"	"	25.4
Inches to Centimeters,	"	"	2.54
Feet to Meters,	"	"	.3048
Yards to Meters,	"	"	.9144
Yards to Kilometers,	"	"	.0009
Miles to Kilometers,	"	"	1.6
Millimeters to Inches,	"	"	.04
Centimeters to Inches,	"	"	.4
Meters to Feet,	"	"	3.3
Meters to Yards,	"	"	1.1
Kilometers to Yards,	"	"	1093.6
Kilometers to Miles,	"	"	.62

1 Yard=0.9144 Meter. 1 Sq. Meter=1.196 sq. yds. 1 Liter=1.760 Imperial Pints or 0.22 Imperial Gal. 1 Liter=2.113 U. S. Pints.

COMPARISON OF THERMOMETERS

Freezing Point = 32° Fahrenheit
" " = 0° Centigrade
Boiling Point = 212° Fahrenheit
" " = 100° Centigrade

To ascertain Fahrenheit temperature, Centigrade being given:

Cent. × 1 8/10 + 32° = Fahr.

To ascertain Centigrade temperature, Fahrenheit being given:

Fahr. — 32° × 5/9 = Cent.

EQUIVALENT WEIGHTS AND MEASURES OF METRIC AND ENGLISH SYSTEMS

Volume and Capacity

1 cubic meter = 35.314 cubic feet
1.308 cubic yards
264.2 gal. (231 cubic inches)

1 cubic decimeter = 61.023 cubic inches
.0353 cubic feet

1 cubic centimeter = .061 cubic inch

1 liter = 1 cubic decimeter
61.023 cubic inches
.0353 cubic feet
1.0567 quarts (U. S.)
.2642 gallons (U. S.)
2.2046 pounds of water at 39.2° F.

1 cubic yard = .7645 cubic meter

1 cubic foot = .02832 cubic meter
28.317 cubic decimeters
28.317 liters

1 cubic inch = 16.387 cubic centimeters

1 gallon (British) = 4.543 liters

1 gallon (U. S.) = 3.785 liters

Weights

1 gram = 15.432 grains

1 kilogram = 2.2046 pounds

1 metric ton = .9842 tons of 2240 pounds
19.68 hundred weight
2204.6 pounds

1 grain = .0648 gram

1 ounce avoirdupois = 28.35 grams

1 pound = .4536 kilograms

1 ton or 2240 pounds = 1.016 metric tons
1016 kilograms

(Continued on page 125.)

EQUIVALENT WEIGHTS AND MEASURES OF METRIC AND ENGLISH SYSTEMS—

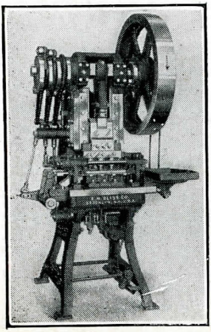
Continued.

Surface

1 square meter = { 10.764 square feet.
1.196 square yards.
1 square centimeter = .155 square inch.
1 square millimeter = .00155 square inch.
1 square yard = .836 square meter.
1 square foot = .0929 square meter.
1 square inch = { 6.452 square centimeters.
645.2 square millimeters.

Length

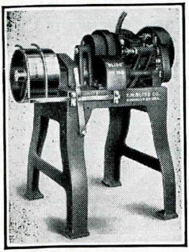
1 meter = { 39.37 inches.
3.28083 feet.
1.0936 yards.
1 centimeter = .3937 inch.
1 millimeter = { .03937 inch, or
1/25 inch, nearly.
1 kilometer = 0.62137 mile.
1 foot = .3048 meter.
1 inch = { 2.54 centimeters.
25.4 milimeters.



AUTOMATIC FEEDS.—"Bliss" presses are arranged with various styles of feeds according to requirements. The illustration shows press with friction dial and lateral feeds. As arranged the press performs four operations simultaneously at each stroke.

COMPARISON OF U. S. AND FOREIGN WEIGHTS AND MEASURES

	WEIGHTS		LIQUID MEASURES		DRY MEASURES	
	Name	U.S. Lbs. Av.	Name	U. S. Gals.	Name	U.S. Bush.
Austria	Pfund	= 1.235	Eimer	= 14.95	Nutze	= 1.745
Bremen	"	= 1.099	Stubchen	= .851	Scheffel	= 2.103
Buenos Ayres	Libra	= 1.0127	Frasco	= .627	Fanega	= 3.894
China	Catty	= 1.3333			Sei	= 3.472
Cuba	Libra	= 1.0119	Arroba	= 4.1	Fanega	= 3.124
Denmark	Pund	= 1.1025	Pott	= .255	Fonda	= 3.948
England	Pound	= 1.	Imp. Gallon	= 1.2003	Imp. Bushel	= 1.0315
France	Kilo	= 2.2046	Litre	= .2642	Hectolitre	= 2.838
Hamburg	Pfund	= 1.0683	Ohm	= 38.278	Fass	= 1.56
Japan	Monme	= 3.858	Masa	= .459		
Mexico	Libra	= 1.0119	Frasco	= .4	Fanega	= 1.547
Norway and Sweden	Skalpund	= .937	Kamea	= .662		
Papal States	Libbra	= .7475	Barile (w'e)	= 15.412	Rubblio	= .836
Portugal	Libra	= 1.0119	Almude	= 4.422	Alqueire	= .393
Russia	Fuat	= 1.097	Vedro	= 3.249	Chetviert	= 5.956
Turkey	Oke	= 2.834			Kilo	= 1.001



"BLISS" AUTOMATIC THREAD-ROLLING MACHINES—Built in a large number of different types and sizes. Adapted for rolling sheet metal screws on such articles as Mason fruit jar tops, salt and pepper tops, harness oil can tops, lamp burners, etc.

DECIMAL EQUIVALENTS

of 8ths, 16ths, 32ds and 64ths of an inch.

8ths.

$\frac{1}{8}$ = .125
$\frac{1}{4}$ = .250
$\frac{3}{8}$ = .375
$\frac{1}{2}$ = .500
$\frac{5}{8}$ = .625
$\frac{3}{4}$ = .750
$\frac{7}{8}$ = .875

16ths.

$\frac{1}{16}$ = .0625
$\frac{3}{16}$ = .1875
$\frac{5}{16}$ = .3125
$\frac{7}{16}$ = .4375
$\frac{9}{16}$ = .5625
$\frac{11}{16}$ = .6875
$\frac{13}{16}$ = .8125
$\frac{15}{16}$ = .9375

32ds.

$\frac{1}{32}$ = .03125
$\frac{3}{32}$ = .09375
$\frac{5}{32}$ = .15625
$\frac{7}{32}$ = .21875
$\frac{9}{32}$ = .28125
$\frac{11}{32}$ = .34375
$\frac{13}{32}$ = .40625
$\frac{15}{32}$ = .46875
$\frac{17}{32}$ = .53125
$\frac{19}{32}$ = .59375
$\frac{21}{32}$ = .65625
$\frac{23}{32}$ = .71875
$\frac{25}{32}$ = .78125
$\frac{27}{32}$ = .84375
$\frac{29}{32}$ = .90625
$\frac{31}{32}$ = .96875

64ths.

$\frac{1}{64}$ = .015625
$\frac{3}{64}$ = .046875
$\frac{5}{64}$ = .078125
$\frac{7}{64}$ = .109375
$\frac{9}{64}$ = .140625
$\frac{11}{64}$ = .171875
$\frac{13}{64}$ = .203125
$\frac{15}{64}$ = .234375
$\frac{17}{64}$ = .265625
$\frac{19}{64}$ = .296875
$\frac{21}{64}$ = .328125
$\frac{23}{64}$ = .359375
$\frac{25}{64}$ = .390625
$\frac{27}{64}$ = .421875
$\frac{29}{64}$ = .453125
$\frac{31}{64}$ = .484375
$\frac{33}{64}$ = .515625
$\frac{35}{64}$ = .546875
$\frac{37}{64}$ = .578125
$\frac{39}{64}$ = .609375
$\frac{41}{64}$ = .640625
$\frac{43}{64}$ = .671875
$\frac{45}{64}$ = .703125
$\frac{47}{64}$ = .734375
$\frac{49}{64}$ = .765625
$\frac{51}{64}$ = .796875
$\frac{53}{64}$ = .828125
$\frac{55}{64}$ = .859375
$\frac{57}{64}$ = .890625
$\frac{59}{64}$ = .921875
$\frac{61}{64}$ = .953125
$\frac{63}{64}$ = .984375

ENGLISH INCHES INTO MILLIMETERS

In.	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
0	0.0	1.6	3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	25.4	27.0	28.6	30.2	31.7	33.3	34.9	36.5	38.1	39.7	41.3	42.9	44.4	46.0	47.6	49.2
2	50.8	52.4	54.0	55.6	57.1	58.7	60.3	61.9	63.5	65.1	66.7	68.3	69.8	71.4	73.0	74.6
3	76.2	77.8	79.4	81.0	82.5	84.1	85.7	87.3	88.9	90.5	92.1	93.7	95.2	96.8	98.4	100.0
4	101.6	103.2	104.8	106.4	108.0	109.5	111.1	112.7	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	127.0	128.6	130.2	131.8	133.4	134.9	136.5	138.1	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	152.4	154.0	155.6	157.2	158.8	160.3	161.9	163.5	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2
7	177.8	179.4	181.0	182.6	184.2	185.7	187.3	188.9	190.5	192.1	193.7	195.3	196.9	198.4	200.0	201.6
8	203.2	204.8	206.4	208.0	209.6	211.1	212.7	214.3	215.9	217.5	219.1	220.7	222.3	223.8	225.4	227.0
9	228.6	230.2	231.8	233.4	235.0	236.5	238.1	239.7	241.3	242.9	244.5	246.1	247.7	249.2	250.8	252.4
10	254.0	255.6	257.2	258.8	260.4	261.9	263.5	265.1	266.7	268.3	269.9	271.5	273.1	274.6	276.2	277.8
11	279.4	281.0	282.6	284.2	285.7	287.3	288.9	290.5	292.1	293.7	295.3	296.9	298.4	300.0	301.6	303.2
12	304.8	306.4	308.0	309.6	311.1	312.7	314.3	315.9	317.5	319.1	320.7	322.3	323.8	325.4	327.0	328.6
13	330.2	331.8	333.4	335.0	336.5	338.1	339.7	341.3	342.9	344.5	346.1	347.7	349.2	350.8	352.4	354.0
14	355.6	357.2	358.8	360.4	361.9	363.5	365.1	366.7	368.3	369.9	371.5	373.1	374.6	376.2	377.8	379.4
15	381.0	382.6	384.2	385.8	387.3	388.9	390.5	392.1	393.7	395.3	396.9	398.5	400.0	401.6	403.2	404.8
16	406.4	408.0	409.6	411.2	412.7	414.3	415.9	417.5	419.1	420.7	422.3	423.9	425.4	427.0	428.6	430.2
17	431.8	433.4	435.0	436.6	438.1	439.7	441.3	442.9	444.5	446.1	447.7	449.3	450.8	452.4	454.0	455.6
18	457.2	458.8	460.4	462.0	463.5	465.1	466.7	468.3	469.9	471.5	473.1	474.7	476.2	477.8	479.4	481.0
19	482.6	484.2	485.8	487.4	488.9	490.5	492.1	493.7	495.3	496.9	498.5	500.1	501.6	503.2	504.8	506.4
20	508.0	509.6	511.2	512.8	514.3	515.9	517.5	519.1	520.7	522.3	523.9	525.5	527.0	528.6	530.2	531.8
21	533.4	535.0	536.6	538.2	539.7	541.3	542.9	544.5	546.1	547.7	549.3	550.9	552.4	554.0	555.6	557.2
22	558.8	560.4	562.0	563.6	565.1	566.7	568.3	569.9	571.5	573.1	574.7	576.3	577.8	579.4	581.0	582.6
23	584.2	585.8	587.4	589.0	590.5	592.1	593.7	595.3	596.9	598.5	600.1	601.7	603.2	604.8	606.4	608.0

39.37 inches = 1 m. = 10 d/m. = 100 c/m. = 1000 m/m. 24.00 inches = 0.6096 m. 1 yard = 0.9144 m. 1 mile = 1609.3 m.

TABLE OF DECIMAL EQUIVALENTS OF MILLIMETERS AND FRACTIONS OF MILLIMETERS

M/m	Ins.	M/m	Ins.	M/m	Ins.	M/m	Ins.
$\frac{1}{100}$	.00039	$\frac{33}{100}$	.01299	$\frac{64}{100}$	.02520	$\frac{95}{100}$	.03740
$\frac{2}{100}$	.00079	$\frac{34}{100}$	.01339	$\frac{65}{100}$	.02559	$\frac{96}{100}$	.03780
$\frac{3}{100}$	.00118	$\frac{35}{100}$	.01378	$\frac{66}{100}$	.02598	$\frac{97}{100}$	.03819
$\frac{4}{100}$	.00157	$\frac{36}{100}$	.01417	$\frac{67}{100}$	.02638	$\frac{98}{100}$	.03858
$\frac{5}{100}$	.00197	$\frac{37}{100}$	.01457	$\frac{68}{100}$	.02677	$\frac{99}{100}$	.03898
$\frac{6}{100}$	.00236	$\frac{38}{100}$	.01496	$\frac{69}{100}$	.02717	1	.03937
$\frac{7}{100}$	.00276	$\frac{39}{100}$	.01535	$\frac{70}{100}$	.02756	2	.07874
$\frac{8}{100}$	.00315	$\frac{40}{100}$	.01575	$\frac{71}{100}$	.02795	3	.11811
$\frac{9}{100}$	.00354	$\frac{41}{100}$	.01614	$\frac{72}{100}$	.02835	4	.15748
$\frac{10}{100}$	.00394	$\frac{42}{100}$	.01654	$\frac{73}{100}$	.02874	5	.19685
$\frac{11}{100}$	.00433	$\frac{43}{100}$	.01693	$\frac{74}{100}$	.02913	6	.23622
$\frac{12}{100}$	.00472	$\frac{44}{100}$	.01732	$\frac{75}{100}$	.02953	7	.27559
$\frac{13}{100}$	.00512	$\frac{45}{100}$	.01772	$\frac{76}{100}$	.02992	8	.31496
$\frac{14}{100}$	.00551	$\frac{46}{100}$	.01811	$\frac{77}{100}$	.03032	9	.35433
$\frac{15}{100}$	.00591	$\frac{47}{100}$	.01850	$\frac{78}{100}$	.03071	10	.39370
$\frac{16}{100}$	.00630	$\frac{48}{100}$	.01890	$\frac{79}{100}$	.03110	11	.43307
$\frac{17}{100}$	.00669	$\frac{49}{100}$	.01929	$\frac{80}{100}$	.03150	12	.47244
$\frac{18}{100}$	.00709	$\frac{50}{100}$	.01969	$\frac{81}{100}$	.03189	13	.51181
$\frac{19}{100}$	.00748	$\frac{51}{100}$	.02008	$\frac{82}{100}$	.03228	14	.55118
$\frac{20}{100}$	.00787	$\frac{52}{100}$	.02047	$\frac{83}{100}$	.03268	15	.59055
$\frac{21}{100}$	.00827	$\frac{53}{100}$	.02087	$\frac{84}{100}$	.03307	16	.62992
$\frac{22}{100}$	.00866	$\frac{54}{100}$	.02126	$\frac{85}{100}$	.03346	17	.66929
$\frac{23}{100}$	.00906	$\frac{55}{100}$	.02165	$\frac{86}{100}$	.03386	18	.70866
$\frac{24}{100}$	.00945	$\frac{56}{100}$	.02205	$\frac{87}{100}$	.03425	19	.74803
$\frac{25}{100}$	.00984	$\frac{57}{100}$	.02244	$\frac{88}{100}$	.03465	20	.78740
$\frac{26}{100}$	.01024	$\frac{58}{100}$	.02283	$\frac{89}{100}$	.03504	21	.82677
$\frac{27}{100}$	.01063	$\frac{59}{100}$	.02323	$\frac{90}{100}$	.03543	22	.86614
$\frac{28}{100}$	.01102	$\frac{60}{100}$	.02362	$\frac{91}{100}$	.03583	23	.90551
$\frac{29}{100}$	.01142	$\frac{61}{100}$	.02402	$\frac{92}{100}$	.03622	24	.94488
$\frac{30}{100}$	.01181	$\frac{62}{100}$	.02441	$\frac{93}{100}$	.03661	25	.98425
$\frac{31}{100}$	.01220	$\frac{63}{100}$	.02480	$\frac{94}{100}$	.03701	26	1.02362
$\frac{32}{100}$	.01260						

10 M/m = 1 centimeter = 0.3937 inches.
10 C/m = 1 decimeter = 3.937 inches.
10 D/m = 1 meter = 39.37 inches.
25.4 M/m = 1 English inch.

USEFUL FACTORS

Copyrighted, Industrial Press, 1904

Inches × 0.08333 = feet
Inches × 0.02778 = yards
Inches × 0.00001578 = miles

Square inches × 0.00695 = square feet
Square inches × 0.0007716 = square yards

Cubic inches × 0.00058 = cubic feet
Cubic inches × 0.0000214 = cubic yards
Cubic inches × 0.004329 = U. S. gallons

Feet × 0.3334 = yards
Feet × 0.00019 = miles

Square feet × 144.00 = square inches
Square feet × 0.1112 = square yards

Cubic feet × 1728.00 = cubic inches
Cubic feet × 0.03704 = cubic yards
Cubic feet × 7.48 = U. S. gallons

Yards × 36.000 = inches
Yards × 3.000 = feet
Yards × 0.0005681 = miles

Square yards × 1296.000 = square inches
Square yards × 9.000 = square feet

Cubic yards × 46656.000 = cubic inches
Cubic yards × 27.000 = cubic feet

Miles × 63360.000 = inches
Miles × 5280.000 = feet
Miles × 1760.00 = yards

Avoir. oz. × 0.0625 = pounds
Avoir. oz. × 0.00003125 = tons

Avoir. lbs. × 16.000 = ounces
Avoir. lbs. × 0.001 = hundredwt.
Avoir. lbs. × 0.0005 = tons
Avoir. lbs. = 27.681 cubic in. water at 39.2° F.

Avoir. tons × 32000.00 = ounces
Avoir. tons × 2000.00 = pounds

Watts × 0.00134 = horse power

Horse power × 746.00 = watts

Weight of round iron per foot = square of diameter in quarter inches ÷ 6.

Weight of flat iron per foot = width × thickness × 10–3.

Weight of flat plates per square foot = 5 lbs. for each ⅛ inch thickness.

(Continued on page 131)

USEFUL FACTORS—Continued

Copyrighted, Industrial Press, 1904

Weight of chain = diameter squared × 10.7 (approximately).

Safe load (in 1.000 pounds) for chains = square of quarter inches in diameter of bar.

WATER FACTORS

U. S. gallons	× 8.33	= pounds
U. S. gallons	× 0.13368	= cubic feet
U. S. gallons	× 231.00	= cubic inches
U. S. gallons	× 0.83	= Eng. gallons
U. S. gallons	× 3.78	= liters
Eng. gals. (Imp.)	× 10.	= pounds
Eng. gals. (Imp.)	× 0.16	= cubic feet
Eng. gals. (Imp.)	× 277.274	= cubic inches
Eng. gals. (Imp.)	× 1.2	= U. S. gallons
Eng. gals. (Imp.)	× 4.537	= liters
Cu. ft. water (39.1°)	× 62.425	= pounds
Cu. ft. water (39.1°)	× 7.48	= U. S. gallons
Cu. ft. water (39.1°)	× 6.232	= Eng. gallons
Cu. ft. water (39.1°)	× 0.028	= tons
Cubic foot of ice	× 57.2	= pounds
Cu. in. water (39.1°)	× 0.036024	= pounds
Cu. in. water (39.1°)	× 0.004329	= U. S. gallons
Cu. in. water (39.1°)	× 0.003607	= Eng. gallons
Cu. in. water (39.1°)	× 0.576384	= ounces
Pounds of water	× 27.72	= cubic inches
Pounds of water	× 0.01602	= cubic feet
Pounds of water	× 0.083	= U. S. gallons
Pounds of water	× 0.10	= Eng. gallons
Tons of water	× 268.80	= U. S. gallons
Tons of water	× 224.00	= Eng. gallons
Tons of water	× 35.90	= cubic feet
Ounces of water	× 1.735	= cubic inches

A column of water 1 inch square by 1 foot high weighs 0.434 pound.

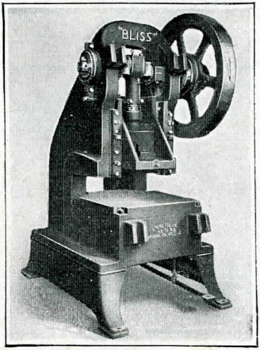
A column of water 1 inch square by 2.31 feet high weighs 1 pound.

Water is at its greatest density at 39.2° F.

Sea water is 1.6 to 1.9 heavier than fresh.

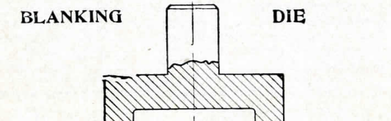
One cubic inch of water makes approximately 1 cubic foot of steam at atmospheric pressure.

27222 cubic feet of steam at atmospheric pressure weighs 1 pound.



"BLISS" STRAIGHT SIDE PRESS WITH CUT BACK FRAME—Made in eight sizes. This style of frame permits the use of dies on large sheets or long strips of metal. Lugs for stay rods are shown.

BLANKING DIE



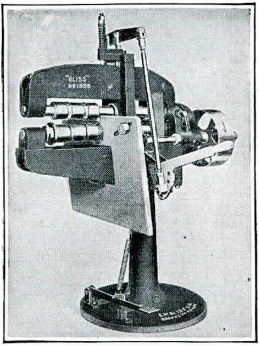
APPROXIMATE WEIGHT AND STRENGTH OF CORDAGE

Circumference in inches	Diameter in inches	Weight of 100 fathoms or 600 feet in lbs.	Weight of 100 fathoms Tarred in lbs.	Strength of New Ropes in lbs.	No. of feet in 1 lb.
6 thd.	3/16 in.	12	17	540	50 feet
9 "	¼ "	18	24	780	33 " 4 in.
12 "	5/16 "	24	34	1000	25 "
15 "	⅜ "	30	45	1280	20 "
1¼ in.	7/16 "	37	50	1562	17 " 8 in.
1½ "	½ "	46	55	2250	13 "
1¾ "	9/16 "	65	85	3062	9 " 3 in.
2 "	⅝ "	80	100	4000	7 " 6 in.
2¼ "	¾ "	98	125	5000	6 "
2½ "	13/16 "	120	155	6250	5 "
2¾ "	⅞ "	142	190	7500	4 " 3 in.
3 "	1 "	170	225	9000	3 " 6 in.
3¼ "	1 1/16 "	200	265	10500	3 "
3½ "	1⅛ "	230	300	12250	2 " 7 in.
3¾ "	1¼ "	271	350	14000	2 " 3 in.
4 "	1 5/16 "	310	405	16000	1 " 11 in.
4¼ "	1⅜ "	346	455	18062	1 " 8 in.
4½ "	1½ "	390	510	20250	1 " 6 in.
4¾ "	1 9/16 "	435	575	22500	1 " 5 in.
5 "	1⅝ "	480	640	25000	1 " 3 in.
5½ "	1¾ "	581	775	30250	1 "
6 "	2 "	678	930	36000	10 2/3 in.

Note that strength given is for new rope. For safe working should be divided by 10.

SOLID BRAIDED SASH CORD

Size No.....................................6, 7, 8, 9, 10, 12
Diameter.............3/16, 7/32, ¼, 9/32, 5/16, ⅜ in.
No. of Ft. to Lb...........66, 55, 44, 36, 27, 20 ft.
Weight
1 Doz. Hanks............18, 22, 27, 33, 44, 60 lbs.



"BLISS" BEADING MACHINE—For beading, corrugating and embossing cylindrical sheet metal articles—as sheet iron stove bodies, stove pipe, powder kegs, and similar work.

SPEED OF CIRCULAR SAWS

Size of Saw	Revs. per Min.	Size of Saw	Revs. per Min.	Size of Saw	Revs. per Min.	Size of Saw	Revs. per Min.
8in.	4,500	26in.	1,384	42in.	870	58in.	625
10 "	3,600	28 "	1,285	44 "	840	60 "	600
12 "	3,000	30 "	1,200	46 "	800	62 "	575
14 "	2,585	32 "	1,125	48 "	750	64 "	550
16 "	2,222	34 "	1,058	50 "	725	66 "	545
18 "	2,000	36 "	1,000	52 "	700	68 "	529
20 "	1,800	38 "	950	54 "	675	70 "	514
22 "	1,636	40 "	900	56 "	650	72 "	500
24 "	1,500	......	....	......	.....	......	.....

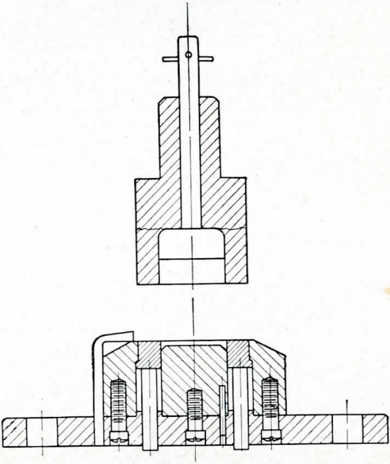
The above table gives a speed of slightly over 9,000 feet per minute for the rim of the saw. Taper ground saws attached to collars or stiffeners should be run at from one-fourth to one-third faster than the speeds named.

TO TEST STEEL AND IRON

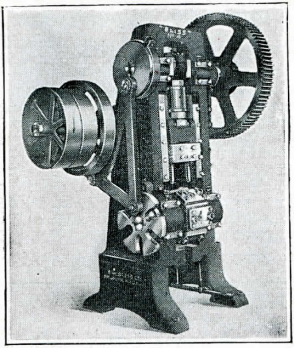
Nitric Acid will produce a black spot on steel: the darker the spot the harder the steel. **Iron**, on the contrary, remains bright if touched with nitric acid. Good steel in its soft state has a curved fracture and a uniform gray lustre; in its hard state a dull, silvery, uniform white. Cracks, threads, or sparkling practice denote bad quality.

Good steel will not bear a white heat without falling to pieces, and will crumble under the hammer at a bright red heat, while at a middling heat it may be drawn out under the hammer to a fine point.

Cleveland Machine Screw Co.



COVER COMBINATION DIE



"BLISS" BOLT HEAD TRIMMING PRESS—With horizontal six sided die holder operated by Geneva stop motion. Usually furnished set on inclined legs but supplied with vertical legs if desired.

CALORIFIC VALUE OF FUELS

FUEL	Calorific Power		Water vaporized at Boiling point, Parts by one part
	Relative	Absolute	
Carbon, pure	1.000	14,500	15.00
Hydrogen	4.280	62,500	62.75
Coal, Anthracite	1.020	14,833	14.98
" Bituminous	1.017	14,796	14.95
" Lignite, dry	0.7	10,150	10.35
Wood, kiln-dried	0.551	8,029	8.10
" air-dried	0.439	6,385	6.45
Charcoal	0.930	13,500	14.00
Coke	0.940	13,620	14.00
Petroleum, heavy, W. Va.	1.250	18,200	18.75
" light, W. Va.	1.260	18,350	18.90
" " Penna.	1.240	18,050	18.60
" heavy, Ohio	1.270	18,450	19.05

TABLE SHOWING THE NUMBER OF DAYS BETWEEN TWO DATES

	To ☞	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
From	Jan	365	31	59	90	120	151	181	212	243	273	304	334
	Feb	334	365	28	59	89	120	150	181	212	242	273	303
	Mar	306	337	365	31	61	92	122	153	184	214	245	275
	April	275	306	334	365	30	61	91	122	153	183	214	244
	May	245	276	304	335	365	31	61	92	123	153	184	214
	June	214	245	273	304	334	365	30	61	92	122	153	183
	July	184	215	243	274	304	335	365	31	62	92	123	153
	Aug	153	184	212	243	273	304	334	365	31	61	92	122
	Sep	122	153	181	212	242	273	303	334	365	30	61	91
	Oct	92	123	151	182	212	243	273	304	335	365	31	61
	Nov	61	92	120	151	181	212	242	273	304	334	365	30
	Dec	31	62	90	121	151	182	212	243	274	304	335	365

To find the number of days between two dates, first look in the table for the number of days between the months and to that add the difference between the days. Thus for the difference in days between Jan. 15 and July 23, look in the table for Jan. on the side and July on the top. In the angle find 181. Subtract 15 from 23, giving 8; add this to 181, making 189. If it were from Jan. 23 to July 15, we should subtract 8, giving 173.

Conklin's Commercial Calculator
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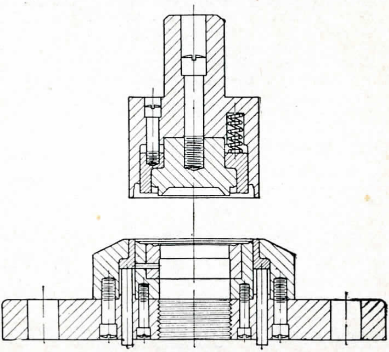
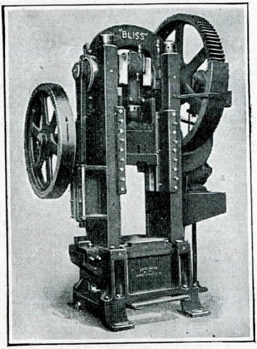


COVER COMBINATION DIE WITH HOLE AND BEAD



"BLISS" STRAIGHT-SIDE TRIMMING PRESS—Shown here with Tie-Rod frame side cutting attachment and direct connected motor drive. Built also with heavy solid frames.

TABLE OF WEIGHTS OF VARIOUS SUBSTANCES

A CUBIC FOOT OF

		Pounds
Loose earth or sand	weighs	95
Common Soil	"	124
Strong Soil	"	127
Clay	"	135
Lead	"	708¾
Brass	"	534¾
Copper	"	555
Wrought Iron	"	486¾
Anthracite Coal	"	50 to 55
Bituminous Coal	"	45 to 55
Charcoal (hardwood)	"	18½
Clay and stones	weigh	160
Bricks	"	125
Cork	weighs	15

NOTES ON STEEL AND IRON

The average weight of wrought iron is 480 lbs. per cubic foot. A bar 1 inch square and 3 feet long weighs, therefore, exactly 10 lbs.

To find the sectional area, given the weight per foot:
Multiply by $\frac{3}{10}$.

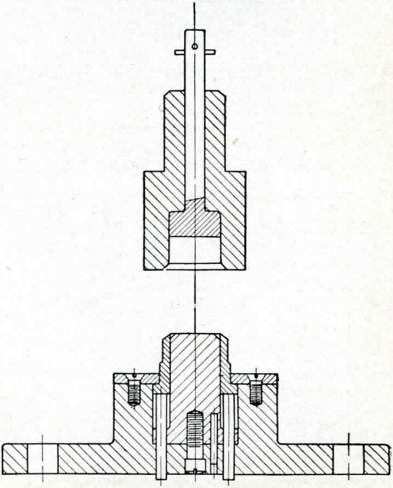
To find the weight per foot, given the sectional area:
Multiply by $\frac{10}{3}$.

The weight of steel is 2 per cent. greater than that of wrought iron.

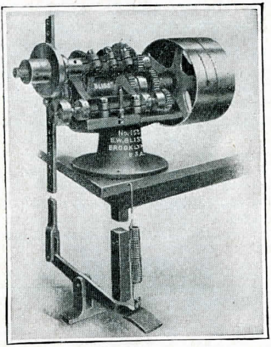
To find sectional area, given weight per foot:
Divide by 3.4.

To find weight per foot, given sectional area:
Multiply by 3.4.

Carnegie Steel Co. 1903



REDUCING DIE



"BLISS" TRIMMING AND BEADING MACHINE—Trimming, beading, flanging, crimping or swaging sheet metal boxes, covers, collars and can bodies, either seamless or pieced.

Horse Power That Can Safely Be Transmitted With the Best Transmission Manilla Rope

Diameter of rope in inches	Horse Power at 2,000 feet velocity per minute	Horse Power at 3,000 feet velocity per minute	Horse Power at 5,000 feet velocity per minute	Effective working tension in lbs.	Diameter of the smallest pulley at center of rope in inches
⅝	2.42	3.63	6.05	40	18
¾	3.62	5.43	9.05	60	22
⅞	4.94	7.41	12.35	82	26
1	6.52	9.78	16.30	108	30
1¼	10.10	15.15	25.25	167	37
1½	14.16	21.90	36.50	242	45
1¾	20.00	30.00	50.00	330	52
2	26 00	39.00	65.00	430	60
2¼	32.90	49.35	82.25	543	68
2½	40.62	60.93	101.55	670	75
3	58 50	87.75	146.25	965	90
3½	79.64	119.46	199.10	1314	105

PRESSURE OF THE ATMOSPHERE

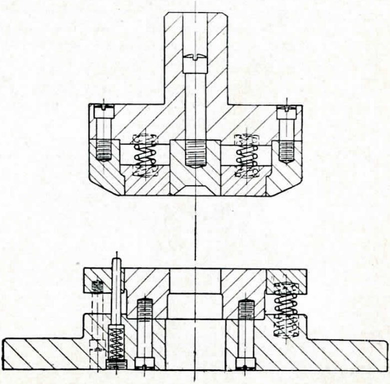
A cubic foot of air at the earth's surface weighs 1.222 ounces; 13.27 cubic feet weigh a pound. The whole atmosphere, or the column of air above the earth's surface as far as the air extends, exerts a downward pressure of 15 lbs. to the square inch, and will support a column of mercury 29.5 inches high. The weight of the atmosphere varies a little with the amount of water it contains, and this is shown by the fluctuations of the height of the column of mercury in the barometer.

SOUND AND LIGHT

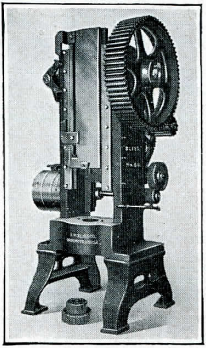
Sound travels at the rate of 1142 feet, or 3-14 of a mile per second, or a mile in about $4\frac{2}{3}$ seconds. In water sound travels at the rate of 4708 feet per second.

Light travels from the earth to the sun, a distance of about 95,000,000 miles in $8\frac{1}{2}$ seconds.

Cleveland Machine Screw Company

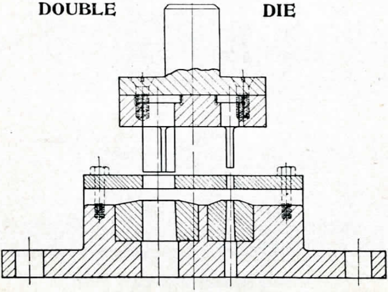


COMPOUND DIE



"BLISS" REDUCING PRESS—With extra long slide actuated by rack and pinion movement. For drawing shells and tubes up to 18 inches in length. Heavy and powerful, with quick, smooth action.

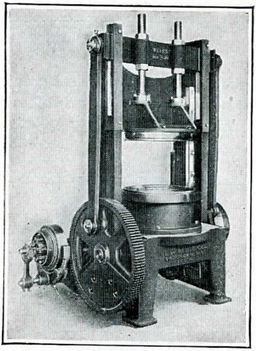
DOUBLE DIE



HORSE POWER TRANSMISSION BY GEARS

Giving the horse power that can be transmitted by a given pitch at a velocity of 100 feet per minute with safety of eight tons, 30,000 pounds.

Pitch	Spur Gears	Bevel Gears	Mitre Gears	MORTISE WHEELS			
				Spur	Pinions	Bevels in pairs	Mitre Gears
	H P	H P	H P	H P	H P	H P	H P
½	.43	.27	.25	....	....	....	....
⅝	.60	.41	.38	....	....	....	....
¾	1.12	.55	.53	....	....	....	....
⅞	1.27	.75	.71	....	....	....	....
1	1.40	1.01	.99	....	....	....	....
1⅛	1.90	1.37	1.34	....	....	....	....
1¼	2.52	1.78	1.74	....	....	....	....
1⅜	3.11	1.96	1.94	....	....	....	....
1½	3.84	2.54	2.41	2.10	2.10	1.48	1.47
1⅝	4.33	2.80	2.94	2.52	2.52	1.80	1.78
1¾	5.48	3.68	3.52	2.92	2.92	2.12	2.09
1⅞	5.90	4.38	3.78	3.45	3.45	2.46	2.42
2	6.83	4.68	4.43	3.94	3.94	2.82	2.79
2⅛	7.90	5.72	5.13	4.49	4.49	3.22	3.17
2¼	8.98	6.39	5.89	5.07	5.07	3.63	3.52
2⅜	9.51	6.57	6.22	5.59	5.59	4.07	4.01
2½	10.70	7.52	7.04	6.34	6.34	3.54	4.41
2⅝	11.27	7.82	7.40	7.03	7.03	5.03	4.92
2¾	12.62	8.72	8.30	7.77	7.77	5.55	5.42
3	15.27	10.87	10.26	9.30	9.30	6.56	6.38
3¼	17.37	12.38	11.77	10.99	10.99	7.88	7.77
3½	20.92	14.78	14.09	12.67	12.67	9.08	8.66
3¾	23.48	16.53	15.85	14.80	14.80	9.61	10.46
4	27.35	18.70	17.78	16.92	16.92	12.12	11.31
4½	35.98	23.02	21.74	21.57	21.57	15.46	15.24
5	45.58	29.91	28.16	26.79	26.79	19.19	18.93
5½	56.21	37.41	35.52	32.57	32.57	23.34	22.59
6	68.37	46.04	42.01	38.91	38.91	27.88	27.50



"BLISS" STRAIGHT-SIDE WIRING PRESS—Special type made in two sizes designed to facilitate handling of large work. Stroke is sufficient to permit insertion or removal of work without moving dies.

TO COMPUTE WEIGHTS OF DIFFERENT MATERIALS

SHEETS

Steel: Divide the thickness, expressed in thousandths, by 25. The result is the weight in pounds per square foot.

Brass: Add 11 per cent. to the weight of sheet steel.

Copper: Add 10 per cent. to weight of sheet steel.

BARS AND PLATES

Iron: Multiply contents in cubic inches by .27777. Result will be weight in pounds.

Steel: Multiply contents in cubic inches by .28332. Result will be weight in pounds.

TO COMPUTE WEIGHTS — Continued

Copper: Multiply contents in cubic inches by .32118. Result will be weight in pounds.

Brass: Multiply contents in cubic inches by .3112. Result will be weight in pounds.

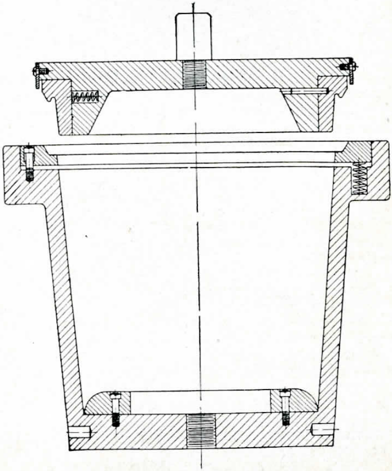
Lead: Multiply contents in cubic inches by .41015. Result will be weight in pounds.

Zinc: Multiply contents in cubic inches by .25318. Result will be weight in pounds.

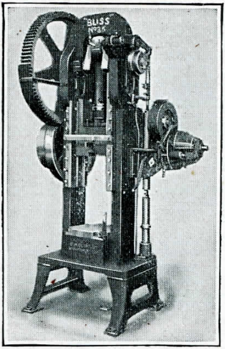
Tin: Multiply contents in cubic inches by .26562. Result will be weight in pounds.

Aluminum: Multiply contents in cubic inches by .09375. Result will be weight in pounds.

Cleveland Machine Screw Co.



WIRING DIE



"BLISS" REDUCING PRESS—Shown here double geared and with crossbar knock out. One of ten sizes of this type designed for reducing the diameter of cups or shells previously cut and formed.

ELECTRICAL UNITS

The electric units are as follows:

Volt—The unit of electrical motive force. Force required to send one ampere of current through one ohm of resistance.

Ohm—Unit of resistance. The resistance offered to the passage of one ampere, when impelled by one volt.

Ampere—Unit of current. The current which one volt can send through a resistance of one ohm.

Coulomb—Unit of quantity. Quantity of current which impelled by one volt would pass through one ohm in one second.

Farad—Unit of capacity. A conductor or condenser which will hold one coulomb under the pressure of one volt.

Joule, unit of work—The work done by one watt in one second.

ELECTRICAL UNITS—Continued

Watt, the unit of electrical energy, and is the product of the ampere and volt. That is, one ampere of current flowing under a pressure of one volt gives one watt of energy.

One electrical horse power is equal to 746 watts.

One Kilowatt is equal to 1,000 watts.

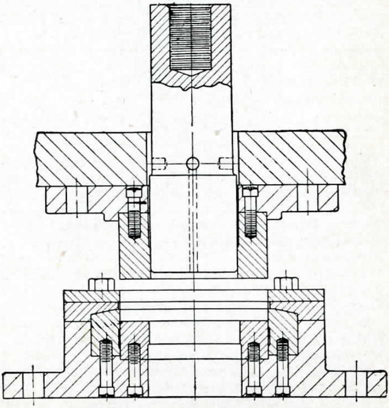
To find the watts consumed in a given electrical circuit, such as a lamp, multiply the volts by the ampers.

To find the volts, divide the watts by the amperes.

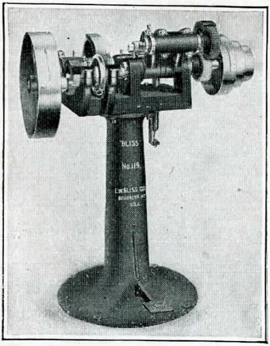
To find the ampers, divide the watts by the volts.

To find the electrical horse power required by a lamp, divide the watts of the lamp by 746.

To find the number of lamps that can be supplied by one electrical horse power of energy, divide 746 by the watts of the lamp.



CUTTING AND DRAWING DIE



"BLISS" THREAD ROLLING MACHINES — One of a number of types and sizes desirable for manufacturers of Sheet Metal Screws. This type will roll from 35 to 50 pieces per minute. Chucks are of simple design, durable and readily changed from one size to another.

ELECTRICAL UNITS — Continued

To find the electrical Horse power necessary, multiply the watts per lamp by the number of lamps and divide by 746.

To find the mechanical horse power necessary to generate the required electrical horse power, divide the latter by the efficiency of the generator.

To find the amperes of a given circuit, of which the volts and ohms resistance are known, divide the volts by the ohms.

To find the volts, when the amperes and watts are known, multiply the amperes by the ohms.

To find the resistance in ohms, when the volts and amperes are known, divide the volts by the amperes.

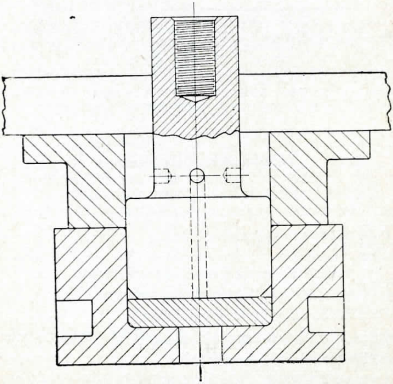
Cleveland Machine Screw Co.

RELATIVE HARDNESS OF WOODS

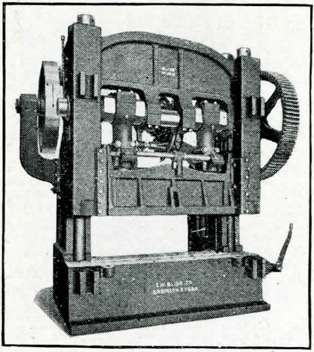
Taking shell bark as the highest standard of our forest trees, and calling that 100, other trees will compare with it as follows:

Shell Bark Hickory	100
Pignut Hickory	96
White Oak	84
White Ash	77
Dogwood	75
Scrub Oak	73
White Haze	72
Apple Tree	70
Red Oak	60
White Beech	65
Black Walnut	65
Yellow Oak	60
White Elm	58
Hard Maple	56
Red Cedar	56
Yellow Pine	54
Chestnut	52
Yellow Poplar	51
Butternut	43
White Birch	43
White Pine	30

Cleveland Machine Screw Company



DRAWING DIE



"BLISS" OVERHANGING DOUBLE-CRANK PRESS—For cutting, punching and stamping operations on large sheets or long strips of metal. Tie-rod frames as shown or solid frames. Built in many sizes, there is one that will answer your requirements.

TUBULAR BOILERS

Each nominal horse-power requires:
8 cubic feet total boiler capacity.
2 cubic feet steam-room.
10 sq. ft. of heating surface—the whole tube surface being taken as effective.
½ square foot of fire-grate surface.
1 cubic foot of water per hour.
10 square inches sectional area of tubes.
13 square inches flue area.
6 square inches chimney area.
Diameter of tubes 1-30th of their length.

U. S. Standard Screw Threads

Diameter of Screw	Thread per Inch	Diameter at root of Thread	Diameter of Screw	Thread per Inch	Diameter at root of Thread
¼	20	.185	2	4½	1.712
5/16	18	.240	2¼	4½	1.962
⅜	16	.294	2½	4	2.175
7/16	14	.344	2¾	4	2.425
½	13	.400	3	3½	2.628
9/16	12	.454	3¼	3½	2.878
⅝	11	.507	3½	3¼	3.100
¾	10	.620	3¾	3	3.317
⅞	9	.731	4	3	3.566
1	8	.837	4¼	2⅞	3.825
1⅛	7	9.40	4½	2¾	4.027
1¼	7	1.065	4¾	2⅝	4.255
1⅜	6	1.160	5	2½	4.480
1½	6	1.284	5¼	2½	4.730
1⅝	5½	1.389	5½	2⅜	4.953
1¾	5	1.490	5¾	2⅜	5.203
1⅞	5	1.615	6	2¼	5.423

Angle of Thread 60°.
Flat at top and bottom ⅛ of pitch.

Whitworth's Standard Screw Threads

Diamete of Screw	No. T. to the Inch	Diameter of Screw	No. T. to the Inch	Diameter of Screw	No. T. to the Inch
¼	20	1⅜	6	3½	3¼
5/16	18	1½	6	3¾	3
⅜	16	1⅝	5	4	3
7/16	14	1¾	5	4¼	2⅞
½	12	1⅞	4½	4½	2⅞
⅝	11	2	4½	4¾	2¾
¾	10	2¼	4	5	2¾
⅞	9	2½	4	5¼	2⅝
1	8	2¾	3½	5½	2⅝
1⅛	7	3	3½	5¾	2½
1¼	7	3¼	3¼	6	2½

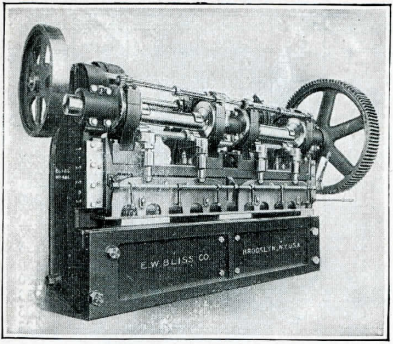
Angle of Thread 55°.

Depth of Thread = about 96 per cent. of pitch or screws.

1-6 of depth is rounded off at both top and bottom, making the actual depth of the Thread about 64 per cent. of the pitch.

Number of threads to inch in square threads = ½ number in angular threads.

Cleveland Machine Screw Co.



"BLISS" MULTIPLE PUNCHING PRESS— One of a number of styles and sizes. Shown equipped with certain special features—eccentric slide adjustment, hand actuated friction clutch and gag attachment for double row of dies and punches

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HOW TO ASCERTAIN HORSE-POWER OF BOILERS

Standard adopted by American Society of Mechanical Engineers, is 30 pounds of water evaporated into dry steam per hour from temperature of feed water 100° Fahrenheit, into steam of 70 pounds pressure.

Compound engines will develop a horse power on 15 pounds of water.

Single condensing engine will develop a horse power on 18 to 22 pounds of water.

Automatic non-condensing engine will develop a horse power on 28 to 32 pounds of water.

Slide valve throttle-governing engine will develop a horse power on one cubic foot or 62½ pounds of water.

Cleveland Machine Screw Co.

STEAM MEMORANDA

A cubic inch of water evaporated under ordinary atmospheric pressure is converted into 1 cubic foot of steam (approximately).

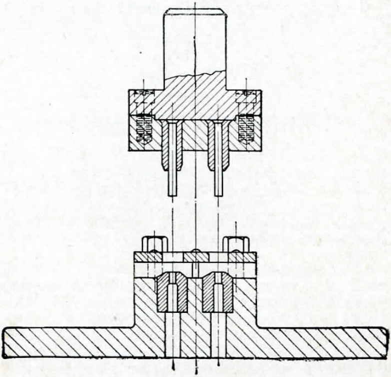
The specific gravity of steam (at atmospheric pressure) is .411 that of air at 34° Fahrenheit, and .0006 that of water at same temperature.

27.222 cubic feet of steam weigh one pound; 13.817 cubic feet of air weigh one pound.

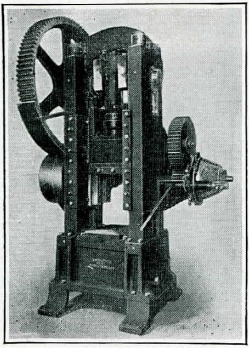
Locomotives average a consumption of 3,000 gallons of water per 100 miles run.

The best designed boilers, well set, with good draft, and skilful firing, will evaporate from 7 to 10 pounds of water per pound of first-class coal.

On one square foot of grate can be burned on an average from 10 to 12 pounds of hard



TWO HOLE PERFORATING DIE



"BLISS" REDUCING PRESSES—Used for reducing in diameter cups or shells previously cut and formed in double-action presses. Also adapted for drawing and forming operations. Wide range of sizes.

STEAM MEMORANDA—Continued

coal, or 18 to 20 pounds soft coal, per hour, with natural draft. With forced draft nearly double these amounts can be burned.

Steam engines, in economy, vary from 14 to 60 pounds of feed water and from 1½ to 7 pounds of coal per hour per indicated H. P. See table below for duty of high grade engines.

Condensing engines require from 20 to 30 gallons of water, at an average low temperature, to condense the steam represented by every gallon of water evaporated in the boilers supplying the engines—approximately for most engines, we say, from 1 to 1½ gallons condensing water per minute, per indicated horse power.

Surface condensers should have about 2 square feet of tube (cooling) surface per horse-

STEAM MEMORANDA—Continued

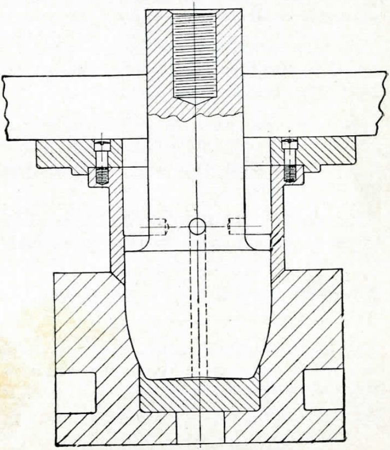
power for a compound steam engine. Ordinary engines will require more surface according to their economy in the use of steam. It is absolutely necessary to place air pumps below condensers to get satisfactory results.

RATIO OF VACUUM TO TEMPERATURE (FAHRENHEIT) OF FEED WATER

00 in., vacuum	212°	27½ in., vacuum	112°
11 " "	190°	28½ " "	92°
18 " "	170°	29 " "	72°
22½ " "	150°	29½ " "	52°
*25 " "	135°		

***Usually considered the standard point of efficiency Condenser and Air Pump being well proportioned.**

Cleveland Machine Screw Company



REDUCING DIE

HINTS ON FORMING ZINC

SEVEN ESSENTIAL POINTS

Some suggestions on forming Rolled Zinc that will aid the metal worker:

1. The depth of the first cup should not be more than 45% to 50% of its diameter. Subsequent steps may be about the same as in brass.

2. The best results will be obtained by starting with a blank of approximately the same gauge as the desired ultimate wall thickness.

3. Use as little tension as possible on the pressure pad, only enough to keep the blank from wrinkling.

4. Give the dies as much radius as possible. This will reduce breakage to a minimum and will also reduce wear on the tools.

5. Annealing and pickling operations are unnecessary and, in fact, harmful to zinc.

6. Soap appears to be the most satisfactory lubricant.

7. In extremely cold weather it is advisable to warm the zinc slightly, preferably in a bath of water heated to not more than 125° Fahrenheit.

New Jersey Zinc Company.

ROLLED ZINC GAUGE

Rolled Zinc Gauge			Am.or Br.& Sharpe		Stubbs	
No.	Sq. Ft. in Lbs.	Thickness in Inches	No.	Appr'x. Thick. Inches	No.	Ap'r'x. Thick. in In.
3	.22	.006	34	.0063	35	.005
—	—	—	—	—	—	—
—	—	—	33	.0070	34	.007
4	.30	.008	32	.0079	33	.008
—	—	—	31	.0089	—	—
—	—	—	—	—	32	.009
5	.37	.010	30	.0100	31	.010
—	—	—	29	.0112	30	.012
6	.45	.012	28	.0126	29	.013
7	.52	.014	27	.0141	28	.014
8	.60	.016	26	.0159	27	.016
—	—	—	25	.0179	26	.018
9	.67	.018	24	.0201	25	.020
10	.75	.020	23	.0225	24	.022
11	.90	.024	22	.0253	23	.025
12	1.05	.028	21	.0284	22	.028
13	1.20	.032	20	.0319	21	.032
14	1.35	.036	19	.0353	20	.035
15	1.50	.040	18	.0403	—	—
16	1.68	.045	17	.0452	19	.042
17	1.87	.050	16	.0508	18	.049
18	2.06	.055	15	.0570	17	.058
19	2.25	.060	14	.0640	16	.065
20	2.62	.070	13	.0719	15	.072
21	3.00	.080	12	.0808	14	.083
22	3.37	.090	11	.0907	13	.095
23	3.75	.100	10	.1018	12	.109
24	4.70	.125	9	.1144	11	.120
—	—	—	8	.1284	10	.134
—	—	—	7	.1442	9	.148
—	—	—	6	.1620	8	.165
—	—	—	5	.1819	7	.180
—	—	—	4	.2043	6	.203
—	—	—	3	.2294	5	.220
—	—	—	—	—	4	.238
25	9.40	.250	2	.2576	3	.259
—	—	—	—	—	2	.284
—	—	—	1	.2893	1	.300
—	—	—	0	.3249	0	.340
26	14.00	.375	000	.4086	000	.425
27	18.75	.500	—	—	—	—
28	37.50	1.000	—	—	—	—

Table for Solving Right-Angled Triangles

PARTS GIVEN.	PARTS TO BE FOUND.				
	Hypotenuse (Hyp.)	Adjacent Side (Adj.)	Opposite Side (Opp.)	Angle.	Opposite Angle.
Hyp. and Adj.	—	—	$\sqrt{\text{Hyp.}^2 - \text{Adj.}^2}$	$\text{Cos.} = \frac{\text{Adj.}}{\text{Hyp.}}$	$\text{Sin.} = \frac{\text{Adj.}}{\text{Hyp.}}$
Hyp. and Opp.	—	$\sqrt{\text{Hyp}^2 - \text{Opp.}^2}$	—	$\text{Sin.} = \frac{\text{Opp.}}{\text{Hyp.}}$	$\text{Cos.} = \frac{\text{Opp.}}{\text{Hyp.}}$
Hyp. and Angle	—	Hyp × Cos.	Hyp. × Sin.	—	90° – Angle.
Adj. and Opp	$\sqrt{\text{Adj}^2 + \text{Opp.}^2}$	—	—	$\text{Tang} = \frac{\text{Opp.}}{\text{Adj.}}$	$\text{Cot.} = \frac{\text{Opp.}}{\text{Adj.}}$
Adj. and Angle	$\frac{\text{Adj.}}{\text{Cos.}}$	—	Adj. × Tang.	—	90° – Angle.
Opp. and Angle	$\frac{\text{Opp.}}{\text{Sin.}}$	Opp. × Cot.	—	—	90° – Angle.

Trigonometrical Expressions

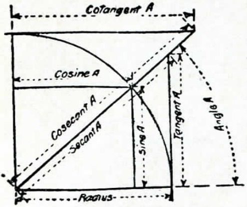


Fig. 17.

The diagram (Fig. 17) shows the different trigonometrical functions in terms of the angle A to the radius = 1.

Complement of an angle = its difference from 90 deg.

Supplement of an angle = its difference from 180 deg.

Trigonometrical Equivalents.

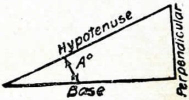
$\sqrt{(1 - \sin.^2)} = \cos.$
Sin. ÷ tan. = cos.
Sin. × cot. = cos.
Sin. ÷ cos. = tan.
Cos. ÷ sin. = cot.
Cos. ÷ cot. = sin.
Tan. ÷ sin. = sec.
Tan. ÷ sec. = sin.
Tan. × cot. = rad.

$\sqrt{(1 - \cos.^2)} = \sin.$
1 ÷ cot. = tan.
1 ÷ sin. = cosec.
1 ÷ cos. = sec.
1 ÷ cosec. = sin.
1 ÷ sec. = cos.
1 ÷ tan. = cot.

$$\text{Sine} = \frac{\text{Perp.}}{\text{Hyp.}} \qquad \text{Cosine} = \frac{\text{Base}}{\text{Hyp.}}$$

$$\text{Secant} = \frac{\text{Hyp.}}{\text{Base}} \qquad \text{Cosecant} = \frac{\text{Hyp.}}{\text{Perp.}}$$

$$\text{Tangent} = \frac{\text{Perp.}}{\text{Base}} \qquad \text{Cotangent} = \frac{\text{Base}}{\text{Perp.}}$$

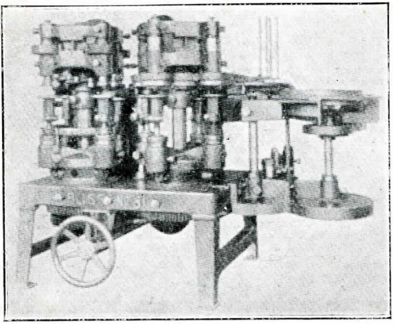


$\frac{\text{PERP}}{\text{BASE}}$ = TAN OF ANGLE A.

$\frac{\text{BASE}}{\text{COS A}}$ = HYP.

HYP × SINE A = PERP.

HYP × COSINE A = BASE.



"BLISS" NO. 81 AUTOMATIC DOUBLE SEAMER

Has eight seaming stations and operates at a speed of 165 cans per minute in the can shop and on solid goods; 80 to 130 cans per minute on liquid, semi-liquid and syrup goods. This machine is simple to operate and reliable, without small, delicate parts.

USEFUL HINTS ON ORDERING SPRINGS

Extension Springs—State size of wire, length of coils, length over all and outside diameter. If hook ends open or closed, knotted or coned. Also if hooks are to be parallel or at right angles. How far to be extended when in use and what strain required.

Compression Springs—State size of wire, length over all, outside or inside diameter, pitch or number of coils, distance to be compressed and by what weight.

Torsion Springs—State size of wire, right or left hand spring, length of body, inside or outside diameter, length over all, length of arms or size of eyes.

From United Spring Co.

HEALTH HINTS

1. **Drink Plenty of Water**—Do not drink too much water during meals. It is more difficult for the stomach to digest food when filled up with water. Drink it frequently between meals.

2. **Do Not Overeat**—An overloaded stomach does not function properly. It clogs the organisms and befogs the brain.

3. **Take Plenty of Outdoor Exercise**—Outdoor exercise such as walking, golfing or the playing of any outdoor game stimulates and refreshes both the nerve system and the physical body.

4. **Protect Your Body with Warm, Clean Clothing.**

5. **Keep Feet Dry and Warm.**

6. **Bathe Often**—In bathing it is well not to use the water too hot as this may result in a shock to the nerve system.

7. **Get Plenty of Sleep**—The average individual requires between seven and eight hours' sleep. Remember what Benjamin Franklin said, "Early to bed and early to rise makes a man healthy, wealthy and wise."

8. **Arrange for Occasional Mental Recreations**—To keep the mind from getting into a rut and from becoming stale you should occasionally provide mental recreation. The type of recreation depends upon the individual. It may be reading, attending theatres, dances, parties, lunches, etc. These are all good forms of recreation providing they are not overdone.

9. **Do Not Smoke to Excess**—Smoking in moderation is not injurious, but when done to excess it may have serious consequences.

10. **Keep Windows Open**—Always sleep with your windows open. Keep some of the windows open in your home during the day. The temperature of a room should be between sixty-eight and seventy degrees.

11. **Take Good Care of Your Teeth**—Teeth affect and are affected by the entire nerve system of the body. Unhealthy teeth result in unhealthy mind and body. It is well to visit your dentist at least once or twice a year, even if only for an examination and thorough cleaning of your teeth.

12. **Practice Deep Breathing Exercises a Few Times Daily**—Deep breathing ventilates the lungs and increases their resistance power.

13. **Breathe Through the Nose**—The organisms of the nose are directly in connection with the lungs, whereas those of the mouth and throat are connected with the stomach. Breathing through the nose is, therefore, most beneficial.

14. **Importance of Regular Bowel Movements**—Retarded bowels are a source of infection to the entire system.

15. **Take no Medicine Without Advice of a Physician**—One cannot be too careful in the taking of medicine. No one except an experienced physician can prescribe correctly for you. You may take headache powders to cure a headache with injurious results because you should be taking other medicine to cure another ailment which is causing the headache.

ACTUAL RATE OF INCOME ON DIVIDEND PAYING STOCKS AT VARIOUS PRICES

Price %	2%	3%	4%	5%	6%	7%	8%
20	10.0	15.0	20.0	25.0	30.0	35.0	40.0
21	9.5	14.3	19.1	23.8	28.6	33.3	38.1
22	9.1	13.6	18.2	22.7	27.3	31.8	36.4
23	8.7	13.0	17.4	21.7	26.1	30.4	34.8
24	8.3	12.5	16.7	20.8	25.0	29.2	33.3
25	8.0	12.0	16.0	20.0	24.0	28.0	32.0
26	7.7	11.5	15.4	19.2	23.1	26.9	30.8
27	7.4	11.1	14.8	18.5	22.2	25.9	29.6
28	7.1	10.7	14.3	17.9	21.4	25.0	28.6
29	6.9	10.3	13.8	17.2	20.7	24.1	27.6
30	6.7	10.0	13.3	16.7	20.0	23.3	26.7
31	6.5	9.7	12.9	16.1	19.4	22.6	25.8
32	6.3	9.4	12.5	15.6	18.8	21.9	25.0
33	6.1	9.1	12.1	15.2	18.2	21.2	24.2
34	5.9	8.8	11.8	14.7	17.7	20.6	23.5
35	5.7	8.6	11.4	14.3	17.1	20.0	22.9
36	5.6	8.3	11.1	13.9	16.7	19.4	22.2
37	5.4	8.1	10.8	13.5	16.2	18.9	21.6
38	5.3	7.9	10.5	13.2	15.8	18.4	21.1
39	5.1	7.7	10.3	12.8	15.4	18.0	20.5
40	5.0	7.5	10.0	12.5	15.0	17.5	20.0
41	4.9	7.3	9.8	12.2	14.6	17.1	19.5
42	4.8	7.1	9.5	11.9	14.3	16.7	19.1
43	4.7	7.0	9.3	11.6	14.0	16.3	18.6
44	4.6	6.8	9.1	11.4	13.6	15.9	18.2
45	4.4	6.7	8.9	11.1	13.3	15.6	17.8
46	4.4	6.5	8.7	10.9	13.0	15.2	17.4
47	4.3	6.4	8.5	10.6	12.8	14.9	17.0
48	4.2	6.3	8.3	10.4	12.5	14.6	16.7
49	4.1	6.1	8.2	10.2	12.2	14.3	16.3
50	4.0	6.0	8.0	10.0	12.0	14.0	16.0
51	3.9	5.9	7.8	9.8	11.8	13.7	15.7
52	3.9	5.8	7.7	9.6	11.5	13.5	15.4
53	3.8	5.7	7.6	9.4	11.3	13.2	15.1
54	3.7	5.6	7.4	9.3	11.1	13.0	14.8
55	3.6	5.5	7.3	9.1	10.9	12.7	14.6
56	3.6	5.4	7.1	8.9	10.7	12.5	14.3
57	3.5	5.3	7.0	8.8	10.5	12.3	14.0
58	3.5	5.2	6.9	8.6	10.3	12.1	13.8
59	3.4	5.1	6.8	8.5	10.2	11.9	13.6
60	3.3	5.0	6.7	8.3	10.0	11.7	13.3
61	3.3	4.9	6.6	8.2	9.8	11.5	13.1
62	3.2	4.8	6.5	8.1	9.7	11.3	12.9
63	3.2	4.8	6.4	7.9	9.5	11.1	12.7
64	3.1	4.7	6.3	7.8	9.4	10.9	12.5
65	3.1	4.6	6.2	7.7	9.2	10.8	12.3
66	3.0	4.6	6.1	7.6	9.1	10.6	12.1
67	3.0	4.5	6.0	7.5	9.0	10.5	11.9
68	2.9	4.4	5.9	7.4	8.8	10.3	11.8
69	2.9	4.4	5.8	7.3	8.7	10.1	11.6
70	2.9	4.3	5.7	7.1	8.6	10.0	11.4
71	2.8	4.2	5.6	7.0	8.5	9.9	11.3
72	2.8	4.2	5.6	6.9	8.3	9.7	11.1
73	2.7	4.1	5.5	6.9	8.2	9.6	11.0
74	2.7	4.1	5.4	6.8	8.1	9.5	10.8
75	2.7	4.0	5.3	6.7	8.0	9.3	10.7

ACTUAL RATE OF INCOME ON DIVIDEND PAYING STOCKS AT VARIOUS PRICES

Price %	4%	5%	6%	7%	8%	9%	10%
76	5.3	6.6	7.9	9.2	10.5	11.8	13.2
77	5.2	6.5	7.8	9.1	10.4	11.7	13.0
78	5.1	6.4	7.7	9.0	10.3	11.5	12.8
79	5.1	6.3	7.6	8.9	10.1	11.4	12.7
80	5.0	6.3	7.5	8.8	10.0	11.3	12.5
81	4.9	6.2	7.4	8.6	9.9	11.1	12.3
82	4.9	6.1	7.3	8.5	9.8	11.0	12.3
83	4.8	6.0	7.2	8.4	9.6	10.8	12.1
84	4.8	6.0	7.1	8.3	9.5	10.7	11.9
85	4.7	5.9	7.1	8.2	9.4	10.6	11.8
86	4.7	5.8	7.0	8.1	9.3	10.5	11.6
87	4.6	5.8	6.9	8.1	9.2	10.3	11.5
88	4.6	5.7	6.8	8.0	9.1	10.2	11.4
89	4.5	5.6	6.7	7.9	9.0	10.1	11.2
90	4.4	5.6	6.7	7.8	8.9	10.0	11.1
91	4.4	5.5	6.6	7.7	8.8	9.9	11.0
92	4.4	5.4	6.5	7.6	8.7	9.8	10.9
93	4.3	5.4	6.5	7.5	8.6	9.7	10.8
94	4.3	5.3	6.4	7.5	8.5	9.6	10.6
95	4.2	5.3	6.3	7.4	8.4	9.5	10.5
96	4.2	5.2	6.3	7.3	8.3	9.4	10.4
97	4.1	5.2	6.2	7.2	8.3	9.3	10.3
98	4.1	5.1	6.1	7.1	8.2	9.2	10.2
99	4.0	5.1	6.1	7.1	8.1	9.1	10.1
100	4.0	5.0	6.0	7.0	8.0	9.0	10.0
101	4.0	5.0	5.9	6.9	7.9	8.9	9.9
102	3.9	4.9	5.9	6.9	7.8	8.8	9.8
103	3.9	4.9	5.8	6.8	7.8	8.7	9.7
104	3.9	4.8	5.8	6.7	7.7	8.7	9.6
105	3.8	4.8	5.7	6.7	7.6	8.6	9.5
106	3.8	4.7	5.7	6.6	7.6	8.5	9.4
107	3.7	4.7	5.6	6.5	7.5	8.4	9.3
108	3.7	4.6	5.6	6.5	7.4	8.3	9.3
109	3.7	4.6	5.5	6.4	7.3	8.3	9.2
110	3.6	4.6	5.5	6.4	7.3	8.2	9.1
111	3.6	4.5	5.4	6.3	7.2	8.1	9.0
112	3.6	4.5	5.4	6.3	7.1	8.0	8.9
113	3.5	4.4	5.3	6.2	7.1	8.0	8.9
114	3.5	4.4	5.3	6.1	7.0	7.9	8.8
115	3.5	4.4	5.2	6.1	7.0	7.8	8.7
116	3.5	4.3	5.2	6.0	6.9	7.8	8.6
117	3.4	4.3	5.1	6.0	6.8	7.7	8.6
118	3.4	4.2	5.0	5.9	6.8	7.6	8.5
119	3.4	4.2	5.0	5.9	6.7	7.6	8.4
120	3.3	4.2	5.0	5.8	6.7	7.5	8.3
125	3.2	4.0	4.8	5.6	6.4	7.2	8.0
130	3.1	3.9	4.6	5.4	6.2	6.9	7.7
135	3.0	3.7	4.4	5.2	5.9	6.7	7.4
140	2.9	3.6	4.3	5.0	5.7	6.4	7.1
145	2.8	3.5	4.1	4.8	5.5	6.2	6.9
150	2.7	3.3	4.0	4.7	5.3	6.0	6.7
155	2.6	3.2	3.9	4.5	5.2	5.8	6.5
160	2.5	3.1	3.8	4.4	5.0	5.6	6.3
165	2.4	3.0	3.6	4.2	4.8	5.5	6.1
170	2.4	2.9	3.5	4.1	4.7	5.3	5.9
175	2.3	2.9	3.4	4.0	4.6	5.1	5.7
180	2.2	2.8	3.3	3.9	4.4	5.0	5.6
190	2.1	2.6	3.2	3.7	4.2	4.7	5.3
200	2.0	2.5	3.0	3.5	4.0	4.5	5.0

DOMESTIC POSTAGE

In effect April 25, 1925. (*Subject to Change.*)

Including Canada, Mexico, Cuba, Republic of Panama, Canal Zone, Hawaii, Porto Rico, Virgin Islands, Philippines, Guam and Tutuilla.

FIRST CLASS (letters, etc.).......... per oz. 2c.
Local Letters (where no free delivery).. " " 1c.
Special Delivery (extra postage) Up to 2 lbs. 10c.; 2 lbs. to 10 lbs. 15c.; over 10 lbs. 20c.
Registered mail (extra postage) Insuring up to $50. 15c.; $50. to $100. 20c.
Return Receipt (additional)........ 3c.
Government Post Cards............. 1c.
Private Mailing and Souvenir Cards.... 2c.
Plain Printed Cards (larger than 3 9/16″ x 5 9/16″) 1 ½c.

SECOND CLASS (unsealed)—All regular newspapers, magazines, etc., 2 cents for each 2 ounces or fraction fully prepaid. Over 8 ounces regular Parcel Post rates.

THIRD CLASS—Merchandise and printed and other mailable matter, except that of the First and Second Class, not exceeding 8 ounces in weight—1 ½ cents for each 2 ounces or fraction—except for books, catalogues, seeds, cuttings, bulbs, roots, scions and plants, the rate of which is 1 cent for each 2 ounces or fraction.

FOURTH CLASS—Domestic Parcel Post. Apply at post office for particulars as to zones, rates and conditions under which parcels may be sent. Limit of weight, 70 lbs. for the 1st, 2nd and 3rd zones, and 50 lbs. for all other zones. Parcels indorsed "Special Handling" to receive same handling, transportation and delivery as First Class matter, require 25c. postage in addition to the regular Fourth Class rate and 2c. service charge which is required on all parcels, except those mailed on rural routes.

INSURED AND COLLECT-ON-DELIVERY. Parcel Post Mail may be insured on payment of fee indicated: Up to $5.00, 5cts.; to $25.00, 8cts.; to $50.00, 10cts.; to $100.00, 25cts.; 3 cents additional for Receipt. *Collect-on-Delivery*, up to $10.00, 12cts.; to $50.00, 15cts.; to $100.00, 25cts.

MONEY ORDER RATES—For orders not exceeding $2.50, 5c.; $2.50 to $5.00, 7c ; $5 to $10, 10c.; $10 to $20, 12c.; $20 to $40, 15c.; $40 to $60, 18c.; $60 to $80, 20c.; $80 to $100, 22c.

FOREIGN POSTAGE—Letters, 5 cents for first ounce; 3 cents for each additional ounce or fraction. Great Britain, Ireland, and many other countries have a 2 cent postage rate from the United States. Consult your Local Post Office regarding this.

Commercial papers, packages of documents, etc., five cents for the first ten ounces or less, and one cent for each additional two ounces or fraction thereof. Postal cards, 2 cents.

DOMESTIC PARCEL POST RATES

Covering all FOURTH CLASS MATTER. The maximum weight of parcels addressed for local delivery and in the first, second and third zones (within 300 miles) is seventy pounds. Beyond the third zone fifty pounds.

FOURTH CLASS.—Merchandise and printed and other mailable matter except that of the First and Second Classes, exceeding 8 ounces in weight.

Postage on FOURTH CLASS matter shall be prepaid at the following rates, with a service charge of 2 cents additional for each parcel. Parcels mailed on rural routes are exempt from the service charge and should be indorsed "Mailed on Rural Route."

Parcels for "SPECIAL HANDLING," i. e.—receiving the same expeditious handling, transportation and delivery as First Class Mail Matter require 25 cents postage in addition to the regular zone rate and service charge.

Within 150 miles (1st and 2d zones) five cents for first lb. and one cent for each additional lb.

Within 300 miles (3rd zone) 6 cents for first lb. and two cents for each additional lb.

Within 600 miles (4th zone) 7 cents for first lb. and four cents for each additional lb.

Within 1000 miles (5th zone) 8 cents for first lb. and six cents for each additional lb.

Within 1400 miles (6th zone) 9 cents for first lb. and eight cents for each additional lb.

Within 1800 miles (7th zone) 11 cents for first lb. and ten cents for each additional lb.

All beyond 1800 miles (8th zone) 12 cents for each lb. or fraction.

The parcel post includes the mailing of books—those weighing 8 ounces or less 1 cent for each 2 ounces or fraction; those weighing in excess of 8 ounces the regular zone rate.

The local rate is applicable to parcels for delivery at the office of mailing or on a rural route starting therefrom.

The address of firm making shipment must be displayed, preceded by the word "from." No advertising matter allowed on outside.

Parcels may contain butter, lard, vegetables, fruit; meat—fresh or dried; millinery; steel, iron or wooden products. Articles not to be sent include intoxicating liquors, poisons, inflammable articles, live or dead animals, poultry, firearms, or anything likely to injure the person of postal employees or damage the mail equipment or other mail matter.

Parcels may be insured actual value only, up to $5,5c; $5 to $25,8c; $25 to $50,10c; $50 to $100,25c.

Parcels may be sent C. O. D. An extra postal fee for collection will be charged.

INDEX

Page

Accidents, Help in Case of................2, 3
Anti-Rust Compound......................113
Atmosphere, Pressure of....................141

Babbit-Metal, Pouring.....................113
Belts, Approx. H. P. Transmitted by......26, 27
Belts, Driving Power of..................24, 25
Blanks, for Drawn Shells.................59–75
Bolts, U. S. Std., Strength and Sizes.........109

Capacity, Tanks...........................50
Case Hardening...........................108
Castings, Shrinkage of.....................119
Cement, for Castings......................114
Cement, Emery Cloth on Polishing Disc.......50
Circles, Circumference and Area of........56, 57
Circles, Area in Square Feet.................58
Circles, Rules Relative to................54, 55
Circular Saws, Speed......................134
Clearances, Die............................98
Comparisons, of U. S. and Foreign
  Weights and Measures...................126
Cordage, Weight and Strength..............133

Days Between Two Dates...................137
Die, Clearances............................98
Drills, Speeds of...........................13
Drills, Tap, for Pipe Taps...................11
Drills, Tap, for Machine and Hand Taps......12
Drills, Twist, Sizes of, With Decimal
  Equivalents, ½″ to No. 80.............14, 15

Electrical Units and Definitions.........146–148
Equivalents, Decimal......................127
Equivalents, Millimeters-Inches.........128, 129
Equivalents, Trigonometrical...............159
Equivalents, Weights and Measures
  of English and Metric Systems........124, 125

Factors, of Safety..........................92
Factors, Useful...................123, 130, 131
Fits, Force...............................115
Fits, Running.............................115
Fits, Shrink..............................117
Fluxes, for Soldering and Welding..........110
Fuels, Calorific Value.....................136

INDEX—Continued

Page
Gauges, American Russia Iron...............36
Gauges, Sheet Zinc, M. & H 36
Gauges, Tin................................37
Gauges, Wire, Different Standards............35

Gauges, U. S. Std. for Uncoated Sheets
and Plates of Iron..................40–41
Gauges, Rolled Zinc.......................157
Gearing, Engine Lathe to Cut Any Pitch.......34
Gearing, Rules on.....................18, 19

Hardness of Woods, Relative...............149
Hardening, Case...........................108
Health Hints..............................161
Heating, Chisels and Lathe Tools............118
Horse-Power...............................121
Horse-Power of Boilers.....................152
Horse-Power, Transmission by Gears........143
Horse-Power, Transmission by Rope.........140

Income, Actual Rate on Dividend
Paying Stocks...................162, 163

Key-Seats, Standard Sizes...................23

Light and Heat............................141
Lubricants, for Cutting Tools................17

Metals, Melting Points................104, 105
Metals, Table of Malleability, Ductility,
Tenacity, Fusibility....................52
Metals, To Expand in Cooling..............114
Metals, Weights and Specific Gravity.....78–105
Metric System............................122

Notes on Steel and Iron....................139
Nuts, U. S. Std., Strength and Size..........109

Pipe and Pipe Threads, Standard.............81
Poisons, Antidotes for 3
Postage 164, 165
Pressures, Punching........................96
Pressures, Shearing........................97
Pressures, Stamping U. S. Coins............116

INDEX—Continued

Page
Ratio of Vacuum to Temperature...........155
Reaming, Amount of Stock to be Left For.....16
Right Angle Triangles, Table for Solving.....158
Roots, Square and Cube................100–103

Screw Threads, Standard..................151
Shafting, H. P. Transmitted by..............29
Shafting, Line............................28
Shells, Blanks for.....................59–75
Shrinkage, Castings.......................119
Softening Cast Iron for Drilling.............114
Solders..............................111, 112
Specific Gravity and Weights, Metals.........105
Specific Gravity, Iron and Steel..............78
Speeds, of Cut, Lathes and Planers...........21
Speeds, Cutting Tools, Feed and Cut..........30
Speeds, Drills.............................13
Speeds, Emerywheels, Grindstones and Polishing Wheels......................19
Speeds, Milling Cutters....................20
Speeds, Pulleys........................22, 23
Speeds, Surface...........................31
Springs, Hints on Ordering.................160
Squares, Sizes Across Corners..............120
Steam Memoranda...................153–155
Steel, Tempering....................106, 107
Stocks, Actual Rate of Income on.......164, 165
Strength, Iron and Steel, Traverse or Shearing...........................94
Strength, Metals.......................93, 94
Stress, (Maximum Working) C. I., W. I. and Steel.............................95

Tanks, Capacity of.........................50
Tempering Steel.....................106, 107
Testing Steel and Iron.....................135
Thermometers, Comparison of..............123
Thickness of Copper Sheets Rolled to Weight.............................53
Triangles, Right Angle, Table for Solving.....158
Trigonometrical Equivalents................159
Trigonometrical Expressions................159
Tubular Boilers...........................150

INDEX—Continued

Page
Water Factors....131
Weight Proportions, C. I. to Pattern Lumber....118
Weights and Measures....32, 33
Weights, Aluminum Sheets and Square and Round Bars....80
Weights, Bar Iron....82, 83
Weights, Bar Steel, Hexagon....84
Weights, Brass, Copper and Tobin Bronze Rods....86, 87
Weights, Brass and Copper Sheets....51–53
Weights, Flat Steel....88–91
Weights, Iron and Steel Sheets....78, 79
Weights of Metals, per Square Foot....85
Weights of Various Substances....138
Weights, Sheet Steel Blanks, (Theoretical)....76, 77
Weights, Tin Plate....37–39
Weights, to Compute for Sheets and Bars....144, 145
Weights, U. S. Std. Ga. Black Sheets....42–49
Weights, U. S. Std. Ga. for Uncoated Sheets and Plates of Iron....40, 41
Weights, Wire....99
Wire Gauges....35

Zinc, Rolled, Gauge....157
Zinc, Hints on Forming....156